

CURRICULUM

Novel Emergency Medicine Curriculum Utilizing Self-Directed Learning and the Flipped Classroom Method: Obstetric and Gynecologic Emergencies Small Group Module

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ABSTRACT:

Audience: This curriculum, created and implemented at The Ohio State University Wexner Medical Center, was primarily designed to educate our emergency medicine (EM) residents post-graduate year (PGY)1-3 and emergency medicine/internal medicine (EM/IM) residents PGY1-5 on core obstetrics and gynecology topics in EM. Additional audience members include medical students and faculty physicians.

Introduction: In 2013, there were over one million emergency department visits in the United States which resulted in primary obstetric or gynecologic diagnoses.¹ Emergency medicine residents must be proficient in the differential diagnosis and management of the wide variety of obstetric and gynecologic emergencies. To do this, we developed a flipped classroom curricular model, which consists of self-directed learning activities completed by learners, followed by small group discussions pertaining to the topic reviewed. The active learning fostered by this type of curriculum increases faculty and learner engagement and interaction time typically absent in traditional lecture-based formats.²⁻⁴ Studies have revealed that the application of knowledge through case studies, personal interaction with content experts, and integrated questions are effective learning strategies for EM residents.⁴⁻⁶ The Ohio State University Wexner Medical Center EM residency didactic curriculum recently transitioned to a “flipped classroom” approach.⁷⁻¹⁰ Our didactic curriculum is delivered over the course of 18 months; however, it could easily be adapted to other academic calendar cycles. The flipped classroom curriculum maximizes didactic time and resident engagement, fosters intellectual curiosity and active learning, and meets the needs of today’s learners.^{3,6,11}

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Objectives: We aim to teach the presentation and management of obstetric and gynecologic emergencies through the creation of a flipped classroom design. This unique, innovative curriculum utilizes resources chosen by education faculty and resident learners, study questions, real-life experiences, and small group discussions in place of traditional lectures. In doing so, a goal of the curriculum is to encourage self-directed learning, improve understanding and knowledge retention, and improve the educational experience of our residents.

Methods: The educational strategies used in this curriculum include small group modules authored by education faculty and content experts based on the core EM content. This program also incorporates submission of questions from residents that were developed during their review of the content prior to the session. The Socratic Method, used during small group sessions, encourages active participation; small groups also focus on the synthesis and application of knowledge through the discussion of real life experiences. The use of free open access medical education (FOAM) resources allows learners to work at their own pace and maximize autonomy.

Topics: Emergency medicine, flipped classroom, medical education, obstetric and gynecologic emergencies, pedagogy, teaching.



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Learner Audience:

Medical students, interns, junior residents, senior residents, attending physicians and faculty

Length of Curriculum:

The entire didactic curriculum was developed to utilize an 18-month curricular cycle; therefore, resident learners experience each curricular topic twice in the course of their residency training. The obstetric and gynecologic module consists of seven 45-60-minute small group sessions.

Topics:

Emergency medicine, flipped classroom, medical education, obstetric and gynecological emergencies, pedagogy, teaching.

Objectives:

Each chapter within our curriculum has individual objectives; however, educational objectives for the curriculum and more specifically, the Obstetric and Gynecologic Emergencies Module include:

1. Resident learners will learn the core content of emergency medicine in an 18-month curriculum utilizing self-directed learning and small group discussions based on the flipped classroom model.
2. After completing the Obstetric and Gynecologic Emergencies Module, resident learners will exhibit mastery within this content area and will critically discuss the pathophysiology, diagnosis, and treatment of various obstetric and gynecologic emergencies including:
 - a. Vaginal bleeding in non-pregnant patients
 - b. Pelvic pain unassociated with pregnancy

- c. Normal pregnancy
- d. Antepartum hemorrhage
- e. Ectopic pregnancy and fertility
- f. Spontaneous abortion and Rh management
- g. Preeclampsia, eclampsia, and HELLP syndrome

Brief introduction:

The flipped classroom learning approach is becoming more commonly recognized as a preferred curricular model for mature learners, specifically those in medical education. This particular model is a natural fit for the hands-on, experiential emergency medicine (EM) learner.⁴ The active learning fostered by this curriculum increases faculty and learner engagement and interaction time, which is typically absent in traditional lecture-based formats.^{5,12} Education literature shows that resident learners prefer learning activities that involve small group discussion, are case/skill based, and emphasize the application of newly obtained knowledge.^{3,4} This educational model also provides a clear channel for the incorporation of evidence-based medicine and increases opportunities for educator-learner conversations. A successful flipped classroom curriculum fosters learner accountability and provides robust opportunities for formal assessment in various EM milestones.^{4,9,12} For these reasons, we developed a flipped classroom curriculum at The Ohio State University Wexner Medical Center. The obstetric and gynecologic curriculum is one of several topics in our overall didactic curriculum.

Problem identification, general and targeted needs assessment:

Traditional lecture-based didactics may not be the most effective or preferred method for EM resident education.⁶ Previously, we predominantly used a traditional lecture format in our residency curriculum despite overwhelming evidence for a more hands-on, “flipped classroom” approach.^{8,9} This method offers resident learners the chance to remain fully engaged relating their own questions and personal experiences to those of others, ultimately providing a manner of learning that allows for greater content retention.⁵

As current literature reveals, both educators and learners benefit from an interactive and collaborative classroom, leading to the creation and implementation of this proposed curricular model at our EM residency program.¹⁰ This weekly small group curriculum has now replaced three hours of traditional lecture-based didactics. Since implementation, residents and educators are engaging in new, valuable flipped classroom learning communities at The Ohio State University Wexner Medical Center. Through the curriculum, we continually seek to foster



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self-directed learning and increased collaboration between resident learners and education faculty members. This ensures that resident time will be maximized and learning will be more efficient and effective, therefore providing a potential positive impact on patient care and physician wellness. Currently, few flipped classroom curricular materials exist that are dedicated to the core content of EM.

Goals of the curriculum:

This curricular innovation was developed and implemented to promote self-directed, active learning and an environment of intellectual curiosity and learner accountability. This flipped classroom curriculum is specifically designed to cover the core content of EM; this module promotes the mastery of obstetric and gynecologic emergencies. Secondary goals include the increased interaction between educators and learners, and the evaluation of resident small group teaching skills.

Objectives of the curriculum:

Each chapter within our curriculum has individual objectives; however, educational objectives for the curriculum and more specifically, the Obstetric and Gynecologic Emergencies Module include:

1. Resident learners will learn the core content of emergency medicine in an 18-month curriculum utilizing self-directed learning and small group discussions based on the flipped classroom model.
2. After completing the Obstetric and Gynecologic Emergencies Module, resident learners will exhibit mastery within this content area and will critically discuss the pathophysiology, diagnosis, and treatment of various obstetric and gynecologic emergencies including:
 - a. Vaginal bleeding in non-pregnant patients
 - b. Pelvic pain unassociated with pregnancy
 - c. Normal pregnancy
 - d. Antepartum hemorrhage
 - e. Ectopic pregnancy and fertility
 - f. Spontaneous abortion and Rh management
 - g. Preeclampsia, eclampsia, and HELLP syndrome

Educational Strategies: (See curriculum chart)

Please refer to the curriculum chart of linked objectives and educational strategies.

Evaluation and Feedback:

This innovative curriculum was literature-based and specifically designed to maximize active learning using the flipped classroom learning model. We overcame initial challenges and skepticism from both educators and learners to execute a successful, novel curricular model. Both resident learners and

faculty educators provided an overwhelming amount of positive feedback. Additionally, a survey was administered to each resident prior to initiation of the curricular innovation, and repeated at the conclusion of the first 18-month cycle. Learners and educators were enthusiastic about the conference structure and expressed a preference for it when compared with traditional lecture-based didactics. Resident learner attendance at weekly EM didactics increased, presumably as a result of our curricular innovation and the associated increase in faculty engagement, active discussions, and learner-perceived value of the sessions. The curriculum is critically evaluated and updated by education faculty members in order to ensure educational material remains current and consistent with the EM core content.

References/suggestions for further reading:

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4. Tan E, Brainard A, Larkin G. Acceptability of the flipped classroom approach for in-house teaching in emergency medicine. *Emerg Med Australas*. 2015;27(5):453-459. doi: 10.1111/1742-6723.12454
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8. Liebert CA, Lin DT, Mazer LM, Berekyei S, Lau JN. Effectiveness of the surgery core clerkship flipped classroom: a prospective cohort trial. *Am J Surg*. 2016;211(2):451-457. doi: 10.1016/j.amjsurg.2015.10.004
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10. Tainter CR, Wong NL, Cudemus-Deseda GA, Bittner EA. The “flipped classroom” model for teaching in the intensive care unit: rationale, practical considerations, and an example of successful implementation. *J Intensive Care Med.* 2017;32(3):187-196. doi: 10.1177/0885066616632156
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Additional Resources:

Educational resources and references are available within each individual appendix in this obstetric and gynecologic emergency curricular module; however, a complete list of educational resources and references are listed below:

Appendix A Vaginal Bleeding in Non-Pregnant Patient References:

1. Casablanca, Y. Management of dysfunctional uterine bleeding. *Obstet Gynecol Clin North Am.* 2008;35(2):219-234. doi: 10.1016/j.ogc.2008.03.001
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Appendix C Normal Pregnancy References:

1. Greer IA. Pregnancy complicated by venous thrombosis. *N Engl J Med.* 2015;373(6):540-547. doi: 10.1056/NEJMcp1407434
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Appendix D Antepartum Hemorrhage References:

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1. Griebel C, Halvorsen J, Golemon TB, Day AA. Management of spontaneous abortion. *Am Fam Physician.* 2005;72(7):1243-1250.
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4. Helman A. Vaginal bleeding in early pregnancy. *Emergency Medicine Cases.* <https://emergencymedicinescases.com/episode-23-vaginal-bleeding-in-early-pregnancy>. Accessed June 14, 2017.

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Topic	Recommended Educational Strategy	Educational Content	Objectives	Learners	Timing, Resources Needed (Space, Instructors, Equipment, Citations of JETem pubs or other literature)	Recommended Assessment, Milestones Addressed
Vaginal Bleeding in Non-Pregnant Patients	<p>- “Flipped” Classroom Discussion of Prereading Material, Case Discussions, and Discussion Questions</p> <p>-Encourage Participants to Share Clinical Experiences to Enhance Discussion</p> <p>-15 Minutes for Brief Topic Review and 30-45 Minutes for Case and Content Discussion</p>	<p>-Pathophysiology of dysfunctional uterine bleeding, post-menopausal bleeding</p> <p>-Discuss the treatment of dysfunctional uterine bleeding, post-menopausal bleeding and post procedural bleeding or trauma</p> <p>-The role of progesterone in management of vaginal bleeding</p>	<p>-Review pathophysiology, diagnosis and treatment of vaginal bleeding disorders in non-pregnant patients including dysfunctional uterine bleeding, post-menopausal bleeding, post procedural bleeding or trauma</p> <p>-Critically discuss the role of progesterone in the management of vaginal bleeding</p> <p>-Discuss management of life-threatening vaginal hemorrhage</p> <p>-Discuss questions posed by residents in their pre- work assignments</p>	PGY-1 PGY-2 PGY-3 Medical Students Faculty	<p>Equipment: Projector and Screen Preferable (instructor can pull up web images during session).</p> <p>-Tables and Space promoting Small Group Discussion.</p> <p>-Instructors: 2 Faculty Members or Content Experts.</p> <p>-Pre-Determined Senior Resident Discussion Leader</p> <p>-Timing: Small Group Discussions Involve No More than 15 Learners and Last 45-60 Minutes</p>	<p>Milestone: PC1, PC2, PC3, PC4, PC5, PC7, MK</p> <p>Assessment: -Learner Preparation and Participation -Senior Resident Teaching Skills</p> <p>-Evaluation: Post-test created using a purchased question bank</p>



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Topic	Recommended Educational Strategy	Educational Content	Objectives	Learners	Timing, Resources Needed (Space, Instructors, Equipment, Citations of JETem pubs or other literature)	Recommended Assessment, Milestones Addressed
Pelvic Pain Unassociated with Pregnancy	<p>- “Flipped” Classroom Discussion of Prereading Material, Case Discussions, and Discussion Questions</p> <p>-Encourage Participants to Share Clinical Experiences to Enhance Discussion</p> <p>-15 Minutes for Brief Topic Review and 30-45 Minutes for Case and Content Discussion</p>	<p>-Pathophysiology, diagnosis and treatment of adult and pediatric causes of pelvic pain</p> <p>- Risk factors for gynecologic emergencies</p> <p>- Differential diagnosis of severe pelvic pain in a non-gravid patient.</p> <p>- Indications and limitations for advanced pelvic imaging in cases of acute pelvic pain</p>	<p>-Review pathophysiology, diagnosis and treatment of conditions causing acute pelvic pain</p> <p>-Describe the risk factors for gynecologic emergencies associated with acute pelvic pain</p> <p>- Develop an acuity based differential diagnosis of severe pelvic pain in a non-gravid patient</p> <p>- Describe the indications for advanced pelvic imaging in cases of acute pelvic pain</p> <p>-Discuss questions posed by residents in their pre- work assignments</p>	PGY-1 PGY-2 PGY-3 Medical Students Faculty	<p>Equipment: Projector and Screen Preferable (instructor can pull up web images during session).</p> <p>-Tables and Space Promoting Small Group Discussion.</p> <p>-Instructors: 2 Faculty Members or Content Experts.</p> <p>-Pre-Determined Senior Resident Discussion Leader</p> <p>-Timing: Small Group Discussions Involve No More than 15 Learners and Last 45-60 Minutes</p>	<p>Milestone: PC1, PC2, PC3, PC4, PC5, PC7, MK</p> <p>Assessment: - Learner Preparation and Participation -Senior Resident Teaching Skills</p> <p>-Evaluation: Post-test created using a purchased question bank</p>



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Topic	Recommended Educational Strategy	Educational Content	Objectives	Learners	Timing, Resources Needed (Space, Instructors, Equipment, Citations of JETem pubs or other literature)	Recommended Assessment, Milestones Addressed
Normal Pregnancy	<p>- “Flipped” Classroom Discussion of Prereading Material, Case Discussions, and Discussion Questions</p> <p>-Encourage Participants to Share Clinical Experiences to Enhance Discussion</p> <p>-15 Minutes for Brief Topic Review and 30-45 Minutes for Case and Content Discussion</p>	<p>-Pathophysiologic changes that occurring during normal pregnancy</p> <p>-Identify common medical and surgical conditions that have specific implications during pregnancy and discuss the evaluation and management of such conditions: urinary tract infections, cardiomyopathy, thromboembolic events, appendicitis, cholecystitis</p> <p>-Discuss risk of common imaging</p>	<p>-Describe changes in vitals that would be expected in normal pregnancy</p> <p>- Articulate the expected physiologic changes that occur during normal pregnancy</p> <p>-Identify common medical and surgical conditions that have specific implications during pregnancy and discuss the evaluation and management of such conditions: urinary tract infections, cardiomyopathy, thromboembolic events, appendicitis, cholecystitis</p> <p>- Discuss risk of common imaging modalities in pregnancy and applications of each</p> <p>- Discuss questions posed by residents in their pre-work assignments</p>	PGY-1 PGY-2 PGY-3 Medical Students Faculty	<p>Equipment: Projector and Screen Preferable (instructor can pull up web images during session).</p> <p>-Tables and Space Promoting Small Group Discussion.</p> <p>-Instructors: 2 Faculty Members or Content Experts.</p> <p>-Pre-Determined Senior Resident Discussion Leader</p> <p>-Timing: Small Group Discussions Involve No More than 15 Learners and Last 45-60 Minutes</p>	<p>Milestone: PC2, PC3, PC4, MK</p> <p>Assessment: - Learner Preparation and Participation -Senior Resident Teaching Skills</p> <p>-Evaluation: Post-test created using a purchased question bank</p>



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Topic	Recommended Educational Strategy	Educational Content	Objectives	Learners	Timing, Resources Needed (Space, Instructors, Equipment, Citations of JETem pubs or other literature)	Recommended Assessment, Milestones Addressed
Antepartum Hemorrhage	<p>- “Flipped” Classroom Discussion of Prereading Material, Case Discussions, and Discussion Questions</p> <p>-Encourage Participants to Share Clinical Experiences to Enhance Discussion</p> <p>-15 Minutes for Brief Topic Review and 30-45 Minutes for Case and Content Discussion</p>	<p>-Physiologic changes related to pregnancy blood volume and their impact on hemorrhagic shock in the pregnant patient</p> <p>-Risk factors for, clinical features, and emergent interventions and management of placental abruption and placenta previa</p> <p>-Traumatic injuries in late pregnancy and diagnostic imaging modalities</p>	<p>-Discuss presenting features of placental abruption and placenta previa.</p> <p>-Review emergent interventions for management of placental abruption.</p> <p>-Recognize high risk traumatic injuries in late pregnancy including MVCs, falls and assault and describe imaging considerations for evaluation of the pregnant trauma patient</p> <p>-Discuss questions posed by residents in their pre-work assignments</p>	PGY-1 PGY-2 PGY-3 Medical Students Faculty	<p>Equipment: Projector and Screen Preferable (instructor can pull up web images during session).</p> <p>-Tables and Space Promoting Small Group Discussion.</p> <p>-Instructors: 2 Faculty Members or Content Experts.</p> <p>-Pre-Determined Senior Resident Discussion Leader</p> <p>-Timing: Small Group Discussions Involve No More than 15 Learners and Last 45-60 Minutes</p>	<p>Milestone: PC1, PC2, PC3, PC4, PC5, PC7, MK</p> <p>Assessment: -Learner Preparation and Participation -Senior Resident Teaching Skills</p> <p>-Evaluation: Post-test created using a purchased question bank</p>



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<p>Ectopic Pregnancy and Fertility</p>	<p>- "Flipped" Classroom Discussion of Prereading Material, Case Discussions, and Discussion Questions</p> <p>-Encourage Participants to Share Clinical Experiences to Enhance Discussion</p> <p>-15 Minutes for Brief Topic Review and 30-45 Minutes for Case and Content Discussion</p>	<p>-Pathophysiology, risk factors, history and physical exam for ectopic pregnancy</p> <p>-The use of serum HCG and ultrasound in the diagnosis of ectopic pregnancy</p> <p>-Determine the management of ectopic pregnancy including both well-appearing patients and unstable patients and determine the indications for medical surgical management of ectopic pregnancy.</p> <p>-Pathophysiology, presentation and management of ovarian hyperstimulation syndrome</p>	<p>Identify the pathophysiology, risk factors, history and physical exam when evaluating ectopic pregnancy</p> <p>-Critically discuss the use of quantitative HCG and ultrasound in the diagnosis of ectopic pregnancy. When following down-trending HCG values, what level rules out ectopic?</p> <p>-Discuss management of ectopic pregnancy including both well-appearing patients and unstable patients and determine the indications for medical surgical management of ectopic pregnancy</p> <p>-Identify current infertility treatment options and potential complications</p> <p>-Discuss the pathophysiology, risk factors, presentation, and management of ovarian hyperstimulation syndrome</p> <p>-Discuss questions posed by residents in their pre-work assignments</p>	<p>PGY-1 PGY-2 PGY-3 Medical Students Faculty</p>	<p>Equipment: Projector and Screen Preferable (instructor can pull up web images during session).</p> <p>-Tables and Space Promoting Small Group Discussion.</p> <p>-Instructors: 2 Faculty Members or Content Experts.</p> <p>-Pre-Determined Senior Resident Discussion Leader</p> <p>-Timing: Small Group Discussions Involve No More than 15 Learners and Last 45-60 Minutes</p>	<p>Milestone: PC1, PC2, PC3, PC4, PC7, MK</p> <p>Assessment: - Learner Preparation and Participation -Senior Resident Teaching Skills</p> <p>-Evaluation: Post-test created using a purchased question bank</p>
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Topic	Recommended Educational Strategy	Educational Content	Objectives	Learners	Timing, Resources Needed (Space, Instructors, Equipment, Citations of JETem pubs or other literature)	Recommended Assessment, Milestones Addressed
Spontaneous Abortion and Rh Management	<p>- “Flipped” Classroom Discussion of Prereading Material, Case Discussions, and Discussion Questions</p> <p>-Encourage Participants to Share Clinical Experiences to Enhance Discussion</p> <p>-15 Minutes for Brief Topic Review and 30-45 Minutes for Case and Content Discussion</p>	<p>-Psychosocial needs with pregnancy loss</p> <p>-Evaluation, management and treatment of a threatened miscarriage</p> <p>-Complications of pregnancy loss</p>	<p>-Understand the psychosocial needs of a patient with pregnancy loss</p> <p>-Articulate the evaluation and management of a threatened miscarriage</p> <p>-Articulate the treatment for a miscarrying patient and when each is appropriate</p> <p>-Discuss when miscarrying patients need evaluation for causes of miscarriage</p> <p>-Discuss the complications of pregnancy loss</p>	PGY-1 PGY-2 PGY-3 Medical Students Faculty	<p>Equipment: Projector and Screen Preferable (instructor can pull up web images during session).</p> <p>-Tables and Space Promoting Small Group Discussion.</p> <p>-Instructors: 2 Faculty Members or Content Experts.</p> <p>-Pre-Determined Senior Resident Discussion Leader</p> <p>-Timing: Small Group Discussions Involve No More than 15 Learners and Last 45-60 Minutes</p>	<p>Milestone: PC1, PC3, PC4, PC5, PC7, MK, ICS1</p> <p>Assessment: - Learner Preparation and Participation -Senior Resident Teaching Skills</p> <p>-Evaluation: Post-test created using a purchased question bank</p>
Preeclampsia, Eclampsia, and HELLP Syndrome	<p>“Flipped” Classroom Discussion of Prereading Material, Case Discussions, and Discussion Questions</p> <p>-Encourage Participants to Share Clinical Experiences to Enhance Discussion</p> <p>-15 Minutes for Brief Topic Review and 30-45 Minutes for Case and Content Discussion</p>	<p>Review the diagnosis, presentation and management of preeclampsia, eclampsia and HELLP syndrome</p> <p>-The use of magnesium and steroid administration for eclampsia</p>	<p>-Review diagnosis and treatment of pre-eclampsia, eclampsia, and HELLP syndrome</p> <p>-Critically discuss the management of hypertension in pregnancy</p>	PGY-1 PGY-2 PGY-3 Medical Students Faculty	<p>Equipment: Projector and Screen Preferable (instructor can pull up web images during session).</p> <p>-Tables and Space Promoting Small Group Discussion.</p> <p>-Instructors: 2 Faculty Members or Content Experts.</p> <p>-Pre-Determined Senior Resident Discussion Leader</p> <p>-Timing: Small Group Discussions Involve No More than 15 Learners and Last 45-60 Minutes</p>	<p>Milestone: PC1, PC2, PC3, PC4, PC5, PC7, MK</p> <p>Assessment: - Learner Preparation and Participation -Senior Resident Teaching Skills</p> <p>-Evaluation: Post-test created using a purchased question bank</p>



Appendix A: Vaginal Bleeding in Non-Pregnant Patient

Objectives

1. Briefly review pathophysiology, diagnosis and treatment of vaginal bleeding disorders in non-pregnant patients including dysfunctional uterine bleeding, post-menopausal bleeding, post-procedure bleeding, or trauma.
2. Critically discuss the role of progesterone in management of vaginal bleeding.
3. Discuss management of life-threatening vaginal hemorrhage.

Case Studies

Case 1: A 36-year-old female patient presents to the emergency department complaining of vaginal bleeding. She reports that she has had irregular bleeding over the past 6 months, but has now had daily bleeding for 2 weeks and is worried that it is lasting so long. She uses 10-12 tampons or pads per day. She has not noted any lightheadedness or dyspnea. She occasionally has pelvic cramping but denies any current pelvic pain. She sees an OBGYN physician annually and denies any history of abnormal pap smear.

Question Prompts:

1. What is the differential diagnosis for this patient's bleeding?
 - a. The differential diagnosis for non-pregnant vaginal bleeding is extensive and includes anatomical uterine and non-uterine abnormalities, endocrine abnormalities, hematologic abnormalities, and traumatic sources. It can be useful to divide up common causes of vaginal bleeding by age group:
 - i. Adolescent – anovulation (hypothalamic-pituitary-ovarian immaturity), exogenous hormones or oral contraceptive pill (OCP), coagulopathy, pelvic infections
 - ii. Reproductive age – anovulation, polycystic ovary syndrome (PCOS), exogenous hormone use or OCP, uterine leiomyomas, cervical and endometrial polyps, thyroid dysfunction
 - iii. Perimenopausal – anovulation, uterine leiomyomas, cervical and endometrial polyps, thyroid dysfunction
 - iv. Postmenopausal – atrophic vaginitis (30%), exogenous hormone use (30%), endometrial lesions, including cancer (30%), other tumors (vulvar, vaginal, cervical) 10%.
 - b. Structural causes include benign growths/tumors polyps, adenomyosis (presence of endometrial glands within the myometrium), Leiomyomas/fibroids. Malignancy should also be considered - more common in elderly/post-menopausal but possible at any age.



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- c. Non-structural causes include coagulopathies (von Willebrand's), ovulatory dysfunction, and hypothyroidism.
 - d. Other causes include pelvic inflammatory disease, cervical erosions, and cervicitis. Also consider vaginal infections, trauma to the vagina or cervix, or foreign bodies. It is important to elicit a history of possible vaginal trauma and to inspect carefully on physical exam to determine if the bleeding is coming from the cervix or a vaginal source.
2. What is the most appropriate diagnostic evaluation for this patient?
 - a. exam is required to determine source of vaginal bleeding to decide if the source is coming from the cervix or the vagina. Pregnancy should be ruled out in patients of reproductive age. Most women with abnormal uterine bleeding should be evaluated with a complete blood count to assess for anemia and thrombocytopenia. This is most important in patients reporting a significant amount of bleeding or symptoms or exam findings that are suggestive of anemia. Thyroid function testing could be considered in the right clinical context. Additional hormonal testing is more appropriate in the outpatient setting if the patient has failed conservative treatment options.
 3. Describe the management options for this patient.
 - a. Most patients with dysfunctional uterine bleeding can be managed as outpatients with consideration for iron replacement, hormonal therapies, and gynecology referral.
 - b. NSAIDs should be used because they can help with cramping discomfort and decrease the amount of bleeding. Tranexamic acid (TXA) is also an option, however less commonly used. For patients without contraindications, a trial of oral contraceptives either estrogen-progestin combination or progestin only are reasonable. Before initiating these therapies in the ED, providers should carefully consider contraindications such as VTE risk, age, smoking status, and history of hypertension. Also, providers should make sure patients have adequate follow up with GYN before initiating a potentially long-term medication for a condition that frequently requires additional outpatient testing.
 4. Would management change if the patient had active bleeding and symptomatic anemia?
 - a. Patients with significant or symptomatic anemia, significant active bleeding, or hemodynamic instability require emergent OBGYN consultation and appropriate resuscitation with fluids or blood products as needed.
 - b. In patients with life-threatening vaginal hemorrhage, the first step is obtaining large bore peripheral access and providing appropriate resuscitation with fluids and/or blood products. Then, providers should attempt to control the source of bleeding. This is best accomplished in the operating room with a gynecologic surgeon. However, if this is not immediately available patients should be given TXA and should reverse other identified coagulopathies. Providers could attempt to cauterize or stitch vaginal lacerations if identified. Massive uterine bleeding is more difficult to control. Attempts to pack the vagina rarely provide effective tamponade and more likely mask ongoing hemorrhage. Depending on the etiology, tamponade devices can be applied inside the uterus such as a Bakri balloon, or multiple Foley catheters if the cervical os is open. In circumstances where gynecology consultation is not available and the patient is unstable for transfer, general surgery should



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be consulted for an emergent operation and potential hysterectomy. Alternatively, interventional radiology could be consulted for embolization.

Case 2: A 78-year-old female patient was brought to the ED by her daughter. Her daughter states that she just found out that the patient has been having vaginal bleeding when her mother asked to borrow a maxi-pad from her today. The patient tells you she thinks it has been going on for 3-4 months. She uses 1-2 pads per day and states that it is usually light bleeding. She has not seen a gynecologist since her children were born. She has not noted any lightheadedness or dyspnea. She denies any pelvic pain. She has had increased constipation. Her daughter thinks that she may have lost some weight in the past few months.

Question Prompts:

1. Describe the diagnostic approach for this patient.
 - a. In the emergent setting, a pelvic exam is required to determine source of vaginal bleeding. Most patients will require a complete blood count and coagulation studies. Consider ED imaging studies such as a CT abdomen-pelvis or pelvic ultrasound in patients with concerning symptoms such as pain or weight loss or a concerning physical exam. However, in the absence of such features, the mainstay of treatment in the otherwise asymptomatic patient is urgent outpatient referral for endometrial biopsy.
2. What follow up recommendations should be given?
 - a. Post-menopausal bleeding requires diagnostic workup with imaging and possible endometrial biopsy to rule out malignancy as a cause of symptoms. Therefore, prompt referral to a gynecologic specialist is mandatory.

Case 3: A 24-year-old female presents to the emergency department complaining of vaginal bleeding. She states she had a cervical procedure in her OBGYN's office yesterday because she had an abnormal pap test. She reports bright red bleeding that started just after the procedure and has been persistent ever since. She denies any associated symptoms.

Question Prompts:

1. What are potential treatment options for this patient?
 - a. Potential management strategies, depending on the severity of bleeding, include conservative management, application of Monsel solution (ferric subsulfate) for hemostasis, or electrocautery or surgical management in conjunction with gynecology consultation.
 - b. In the unstable or massively bleeding patient first start with aggressive resuscitation of the patient. Next attempt bleeding source control; however, for significant, life-threatening bleeding, patients will most often require surgical intervention with gynecology for bleeding source control.



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Suggested Reading:

Casablanca, Y. Management of dysfunctional uterine bleeding. *Obstet Gynecol Clin North Am.* 2008;35(2):219-234. doi: 10.1016/j.ogc.2008.03.001

American College of Obstetricians and Gynecologists. Committee Opinion No. 557: management of acute abnormal uterine bleeding in nonpregnant reproductive-aged women. *Obstet Gynecol.* 2013;121:891–896. doi: 10.1097/01.AOG.0000428646.67925.9a

Lethaby A, Hussain M, Rishworth JR, Rees MC. Progesterone or progestogen-releasing intrauterine systems for heavy menstrual bleeding. *Cochrane Database Syst Rev.* 2015;4:CD002126. doi: 10.1002/14651858.CD002126.pub3

Additional References:

Hang BS. Abnormal Uterine Bleeding. In: Cydulka RK, Michael TF, Joing SA, Wang VJ, Cline DM, Ma OJ, eds. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide.* 8th ed. New York, NY: McGraw-Hill; 2016:619-624.

Hilal Z, Rezniczek GA, Tettenborn Z, Hefler LA, Tempfer CB. Efficacy of Monsel solution after cervical biopsy: a randomized trial. *J Low Genit Tract Dis.* 2016;20(4):312-316. doi: 10.1097/LGT.0000000000000234



Appendix B:

Pelvic Pain: Unassociated with Pregnancy

Objectives

1. Review pathophysiology, diagnosis and treatment of conditions causing acute pelvic pain.
2. Describe the risk factors for gynecologic emergencies associated with acute pelvic pain.
3. Develop an acuity based differential diagnosis of severe pelvic pain in a non-gravid patient.
4. Describe the indications for and limitations of advanced pelvic imaging in cases of acute pelvic pain.

Case Studies

Case 1: A 16-year-old female presents with sudden onset lower abdominal pain that is constant and has lasted for six hours. Her last menstrual period was 18 days ago and she denies any history of sexual intercourse. The patient does not have any other medical problems or history of prior surgeries. VS: HR 115, RR 22 37.8°C, BP 85/60 On physical exam the patient has abdominal distention and severe rigidity and tenderness on palpation of the lower quadrants. Pelvic exam showed diffuse pelvic tenderness, a closed cervical os and no signs of bleeding or trauma. Labs show negative pregnancy testing, mild leukocytosis, and mild anemia.

Question Prompts:

1. What is your initial management of this patient?
 - a. Treat hypotension and tachycardia as presumed hemorrhagic shock. Insert two large bore IV's, administer an IV fluid bolus, pain control as needed, and send a type and cross.
2. What is your differential diagnosis?
 - a. Ovarian cyst rupture.
 - b. Ovarian torsion –less likely given shock presentation (shock with torsion develops in response to ovarian necrosis and would likely occur much later in the course).
 - c. Tubo-ovarian abscess (TOA) – less likely given sexual history and lack vaginal discharge on exam.
3. What diagnostic imaging would you obtain to aid in diagnosis for this patient?
 - a. A FAST scan at bedside is the initial diagnostic test of choice for this patient. It would be diagnostic for free fluid, but not specific in determining the source of bleeding. If the patient stabilizes and is safe to have advanced imaging, a comprehensive pelvic ultrasound should be obtained to characterize suspected ovarian pathology. US has the capacity to not only distinguish between various types of ovarian cysts, it can also aid in identifying associated complications (torsion, hemorrhage, malignancy). Alternatively, a contrasted CT would demonstrate the morphology of the ovary.
4. What is the expected treatment for this patient?



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- a. Most ovarian cysts are simple, ruptured follicular cysts which require no further pharmacologic or surgical management. A hemorrhagic ovarian cyst, however, can cause significant bleeding and be associated with severe shock requiring aggressive resuscitation. Anticipate need for transfusion and emergent OB/gyn consultation for definitive operative management.
- b. Chemical peritonitis from a non-hemorrhagic ruptured ovarian cyst could present similarly, but is usually not associated with moderate to severe shock as in this case. In the case of a corpus luteal cyst, the chemical peritonitis wanes quickly and peritoneal signs are expected to resolve within hours.

Case 2: A 22-year-old female G0P0 presents to the ED with sudden onset of right pelvic pain. The pain is severe, radiates to the low back and has been constant since onset 3 hours ago. The pain was associated with two episodes of emesis. The patient denies any recent illness or associated gastrointestinal or genitourinary symptoms. She has no past medical history and does not take any medications or oral contraceptives. VS: afebrile, HR 90, BP 126/92. Her abdomen is soft, but with voluntary guarding in the right pelvis. Pelvic examination did not demonstrate any vaginal discharge, but moderate tenderness in the right adnexa is present.

Pelvic ultrasound demonstrated bilaterally enlarged ovaries that contained multiple echogenic masses measuring 3cm x 2cm on the right side, and 1cm x 2cm on the left side. The right ovary overall measured 8cm, and left ovary 4cm. Blood supply to both ovaries was described as moderate arterial flow and without venous flow. There was a small amount of free fluid in the pouch of Douglas. Initially, her pain was unresponsive to narcotic analgesics, but she was later discharged home as her symptoms improved.

The following day the patient returned with ongoing right lower quadrant abdominal pain, and laboratory testing showed increasing leukocytosis. She was taken for emergent surgery for possible appendicitis. Laparotomy showed torsion of the right ovary.

Question Prompts:

1. What is the typical presentation of ovarian torsion? How does the presentation differ in the case of intermittent torsion?
 - a. A sudden onset of severe, unilateral pelvic pain associated with nausea and vomiting is classic. Presentation of intermittent or incomplete torsion is much less pronounced, often without severe pain or GI symptoms. The diagnosis of ovarian torsion is easily missed on initial presentation, and cases of right sided torsion have a higher incidence of misdiagnosis than do left sided cases.
2. What are key components of the history to include in any case of suspected ovarian torsion?
 - a. Presence of known ovarian cysts or polycystic ovarian syndrome (PCOS), use of hormonal therapy, or prior procedural or surgical manipulation of the adnexa are risk factors for torsion. Size >4cm but less than 9cm are most likely to develop torsion.
3. Discuss the significance of Doppler flow presence or absence in making a diagnosis of ovarian torsion.



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- a. Abnormal flow on color Doppler ultrasonography increases the likelihood of identifying torsion, but torsion may occur with incomplete vascular obstruction (classically present arterial[high pressure] flow and absent venous [low pressure] flow). Therefore, evidence of vascular flow does not rule out torsion with complete certainty. Absence of venous and arterial flow is the most specific finding. Lack of arterial flow has a positive predictive value of 94%, but represents a very late finding of what may be a non-viable ovary. Normal arterial and venous Doppler scans have been documented in multiple torsion studies, with rates of normal Doppler scans with surgically proven torsion of 13% and 33% in two studies. This discrepancy between ultrasound findings and true disease process can be explained by early or intermittent torsion, a variable degree of twisting, operator skill, and the dual arterial blood supply.
4. In a case of suspected or confirmed ovarian torsion, how would you approach management of the patient?
 - a. Initiate IV fluid resuscitation and pain and nausea control as appropriate. Ovarian torsion is a gynecologic emergency requiring prompt diagnosis and emergent surgical treatment with de-torsion of the ovary and removal of any ovarian abnormalities that caused the torsion.

Case 3: A 25-year-old female G3P3 had her third normal spontaneous vaginal delivery followed by tubal ligation. She experienced a persistent low-grade fever and abdominal pain that began two weeks later after hospital discharge. She presented to the emergency department complaining of worsening fevers and abdominal pain. VS: T 102.8, HR 116, BP 110/60mmHg, and RR 24. On physical exam there is severe tenderness in the left adnexa and non-mobile pelvic mass is palpated. A pelvic examination reveals a large amount of purulent vaginal discharge, severe pain elicited upon cervical motion, and a palpable tender pelvic mass.

Question Prompts:

1. What is your presumptive diagnosis? What are risk factors for this diagnosis?
 - a. Tubo-ovarian abscess (TOA) with possible rupture
 - b. Significant risk factors to consider for TOA include history of sexually transmitted infection (STI) or pelvic inflammatory disease (PID) or history of surgical tubal instrumentation or manipulation.
2. Discuss the management of the condition, including medical treatment, and indications for surgical versus nonsurgical management.
 - a. Empiric treatment for PID should be initiated in women at risk for sexually transmitted diseases if they are experiencing pelvic or lower abdominal pain, if other illnesses have been ruled out and if they have cervical motion tenderness, uterine tenderness, or adnexal tenderness. In addition, one or more of the following criteria enhances the specificity of the diagnosis: fever, abnormal cervical or vaginal mucopurulent discharge, presence of abundant white blood cells on saline microscopy, elevated erythrocyte sedimentation rate, elevated C-reactive protein, and cervical infection with *N. gonorrhoeae* or *C. trachomatis*.



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- b. Sexually transmitted infections, such as *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and *Mycoplasma genitalium*, have all been identified from the cervix, endometrium, and fallopian tubes from women with acute salpingitis diagnosed by laparoscopy. However, endogenous bacterial vaginosis associated with lower genital tract organisms, such as *Prevotella* sp., *Peptostreptococcus* sp., *Gardnerella vaginalis*, *Escherichia coli*, *Haemophilus influenzae*, and aerobic streptococci are found in a high percentage of PID cases. Appropriate antibiotic selection based on Center for Disease Control (CDC) guidelines and pain control are standards of therapy in the emergency setting.
- c. Women with mild or moderate PID achieve clinical outcomes with outpatient oral antibiotics similar to those with inpatient IV antibiotics. Indications for hospital admission are PID associated with pregnancy, lack of response to oral antibiotics, inability to follow or tolerate an outpatient oral regimen, severe illness (nausea and vomiting, fever, or abnormal vitals), cases in which surgical emergencies cannot be excluded, or presence of TOA.
- d. The Centers for Disease Control and Prevention recommends the following intravenous (IV) antibiotics, which have been shown to achieve clinical cure in >90% of patients with acute PID:
 - i. IV cefotetan or IV ceftiofuran plus oral or IV doxycycline
 - ii. IV clindamycin plus IV gentamicin
 - iii. Alternative: ampicillin/sulbactam plus doxycycline.
- e. Emergent OB/gyn consultation should be obtained in case of TOA in order to guide management. It is reasonable to initiate antibiotics alone in women who are hemodynamically stable and when the abscess is 8 cm or less in diameter. When clinical response is not achieved within 48 hours after initiation of antibiotics, then surgical management or drainage should be considered.
- f. Long-term complications of PID/TOA include infertility, ectopic pregnancy, and chronic pelvic pain.

Suggested Readings:

Damigos E, Johns J, Ross J. An update on the diagnosis and management of ovarian torsion. *The Obstetrician and Gynaecologist*. 2012;14(4):229-236. doi: 10.1111/j.1744-4667.2012.00131.x *Table correction in Volume 14, Issue 4, 229–236. In Table 1, Criteria number 2 reads, “pain duration >8 hours.” This should read “pain duration <8 hours” to correspond with the cited paper.

Ovarian Torsion, “answers.” EM Lyceum. <https://emlyceum.com/2012/06/21/ovarian-torsion-answers/>. Published June 21, 2012. Accessed July 22, 2017.

Chappell CA, Wiesenfeld HC. Pathogenesis, diagnosis, and management of severe pelvic inflammatory disease and tubo-ovarian abscess. *Clin Obstet Gynecol*. 2012;55(4):893-903. doi: 10.1097/GRF.0b013e3182714681



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Additional References:

Heniff M, Fleming H. Abdominal and pelvic pain in the nonpregnant female. In: Tintinalli JE, Stapczynski JS, Ma OJ, Yealy DM, Meckler GD, Cline DM, eds. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*. 8th ed. New York, NY: McGraw-Hill; 2016:625-627.

Shepherd S, Weiss B, W Shoff. Pelvic inflammatory disease. In: Tintinalli JE, Stapczynski JS, Ma OJ, Yealy DM, Meckler GD, Cline DM, eds. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*. 8th ed. New York, NY: McGraw-Hill; 2016:668-671.



Appendix C: Normal Pregnancy

Objectives

1. Describe changes in vitals that would be expected in normal pregnancy
2. Articulate the expected physiologic changes that occur during normal pregnancy
3. Identify common medical and surgical conditions that have specific implications during pregnancy and discuss the evaluation and management of:
 1. Urinary Tract Infections
 2. Cardiomyopathy
 3. Thromboembolic events
 4. Appendicitis
 5. Cholecystitis
4. Contrast the risks of common imaging modalities in pregnancy and describe appropriate applications of each modality

Case Studies

Case 1: 25-year-old G4P2 15 weeks with previously confirmed intrauterine pregnancy presents with intermittent mild lower abdominal discomfort and intermittent epigastric discomfort that has occurred for approximately one month. She also reports occasionally feeling her heart racing and some mild shortness of breath with activity. She denies any persistent symptoms or chest pain. On review of systems you discover that she also has urinary frequency and nausea. She states that her family suggested that she get checked to make sure her pregnancy is progressing normally.

Question Prompts:

1. What are normal physiologic changes during pregnancy?
 - a. Normal pregnancy causes the following physiologic changes:
 - i. Increased cardiac output (may lead to increased urinary frequency, exercise intolerance)
 - ii. Decreased gastric motility and sphincter relaxation (may lead to constipation, gastroesophageal reflux disease (GERD), nausea)
 - iii. Decreased functional residual capacity and total lung capacity (may lead to dyspnea, decreased exercise tolerance)
 - iv. Ureters dilate
 - v. Hypercoagulation (persists for six weeks postpartum)
2. What pathologic conditions would you consider in your differential diagnosis for her complaints? How would you proceed with diagnostic evaluation?



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- a. Minimum diagnostic evaluation should assess for genitourinary (GU) infection. Pregnant women are at increased risk for urinary tract infection (UTI)/pyelonephritis. GU infections increase risk of miscarriage and preterm labor and should be treated even if asymptomatic. Consider GERD, biliary colic, constipation, GU infection with regard to abdominal symptoms. Consider arrhythmia, cardiomyopathy, pulmonary embolism (PE), asthma/bronchospasm, infection with regard to associated complaints.

Case 2: 25-year-old G4P2 at 17 weeks with previously confirmed intrauterine pregnancy presents with right lower quadrant pain, anorexia, and nausea. Symptoms began approximately 8 hours ago and she denies any similar symptoms in the past. She denies vaginal bleeding or discharge, leakage of fluids, or urinary complaints.

Question Prompts:

1. What pathologic conditions would you consider in your differential diagnosis for her complaints?
 - a. Diagnostic considerations should include appendicitis, genitourinary infection or kidney stone, ovarian cyst or torsion. Appendicitis is the most common surgical emergency in pregnancy. Rates are equivalent to nonpregnant women; however, perforation rate is higher for pregnant women than in the general population. Note that the appendix/McBurney's point is displaced during pregnancy and exam may be unreliable.
2. How would you proceed with diagnostic evaluation?
 - a. In this case computed tomography (CT) should be avoided to rule out appendicitis. Ultrasonography and MRI are not associated with risk and are the imaging modalities of choice for evaluation of a pregnant patient.

Case 3: 25y G4P2 presents at 25 weeks estimated gestational age (EGA) with chest pain and hypoxia. Heart rate is 110, BP is 85/40, and O2 saturation is 93%.

Question Prompts:

1. Can vital signs be altered by normal pregnancy?
 - a. Vital signs are altered by normal pregnancy and vary by trimester.. Blood pressure decreases in first trimester, levels out in the second trimester, and then returns to nonpregnant levels in the third trimester. Heart rate will increase in pregnancy, rising by 10-15 beats per minute above the baseline mean. In the last two trimesters, due to an enlarging uterus, the inferior vena cava can compress, which can decrease cardiac preload and cardiac output, and can also lower central venous pressure.
2. What is your differential diagnosis for this patient?
 - a. Venous thromboembolic events (VTE) are important to consider in pregnancy. VTE is the leading cause of death in pregnancy and risk of VTE is 6 times that of non-pregnant women. Additionally, cardiomyopathy in pregnancy can cause chest pain, dyspnea, fatigue and swelling and has a high morbidity/mortality with 50% of cases persisting after delivery.



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3. What diagnostic imaging would you obtain and how would you counsel this patient about risks associated with imaging?
 - a. Imaging studies of choice for VTE in pregnancy include compression duplex ultrasound, ventilation-perfusion lung scanning, and CT pulmonary angiography. Estimated fetal radiation dose from chest x-ray is $<0.1\text{mGy}$, from ventilation-perfusion scan is 0.5mGy , and from CT pulmonary angiography is $\leq 0.66\text{mGy}$. Such exposures are considered well below levels associated with teratogenesis. Modeling suggests very small increase in risk of fatal childhood cancers (0.006% per mGy of in utero exposure). American College of Obstetricians and Gynecologists (ACOG) considers radiation exposure through radiography, CT scan, or nuclear medicine imaging techniques is at a dose much lower than the exposure associated with fetal harm and directs that if these techniques are necessary or are most readily available for determining a threatening diagnosis, they should not be withheld from a pregnant patient.

Suggested Readings:

Greer IA. Pregnancy complicated by venous thrombosis. *N Engl J Med*. 2015;373(6):540-547. doi: 10.1056/NEJMcp1407434

Nickson C. Physiology of pregnancy. Life in the Fastlane. <https://lifeinthefastlane.com/ccc/physiology-of-pregnancy>. Updated January 14, 2013. Accessed July 22, 2017.

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Appendix D: Antepartum Hemorrhage

Objectives

1. Discuss presenting features of placental abruption and placenta previa.
2. Review emergent interventions for management of placental abruption.
3. Recognize high-risk traumatic injuries in late pregnancy including motor vehicle collisions (MVCs), falls and assault and describe imaging considerations for evaluation of the pregnant trauma patient.

Case Studies

Case 1: A 30-year-old G2 P1 presents with bright red vaginal bleeding. She is 33 weeks pregnant. She denies pain, is feeling the baby move, and does not note any contractions. HR is 110 and BP 110/76.

Question Prompts:

1. What diagnostic studies should be performed?
 - a. Laboratory investigation includes obtaining a CBC, coagulation studies, and type and cross. It is ideal to confirm normal placental position prior to performing a vaginal exam as disruption of the cervical-placental junction can precipitate hemorrhage. While some patients may be aware of the presence of a placenta previa, or its resolution, this should not be assumed. Placental location confirmation can be done via bedside or comprehensive ultrasound. Ideally, bimanual exams in late trimester pregnant bleeding should be done with obstetric or surgical back up whenever possible and only after ultrasound to evaluate for obstetrical emergency. Caution should be taken with speculum exam as well because this too can precipitate significant bleeding.
2. Given gestational age, what medications could be given to improve outcomes in the fetus?
 - a. Corticosteroids given at less than 34 weeks of gestation will promote fetal lung maturity and generate production of lung surfactants, thus reducing the need for and duration of mechanical ventilation. Betamethasone and dexamethasone can be used.
3. If while performing a vaginal exam on this patient she begins bleeding profusely, how should you manage the bleeding?
 - a. Establish IV access and begin resuscitation efforts and give blood products. Administer Rh immune globulin if Rh negative. Emergency obstetrics consultation should be obtained because immediate cesarean section may be necessary.

Case 2: A 22-year-old G5 P4 presents with abdominal pain. Patient appears concerned but comfortable. She reports that she is having contraction-like pain and vaginal spotting but is only 30 weeks pregnant. Vaginal



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bleeding is reportedly dark and spotty noted only on toilet tissue after using the restroom. VS are HR 100 BP 100/76 RR 20 100% on RA and afebrile.

Question Prompts:

1. If this were an abruption, which class of abruption is this most likely to be?
 - a. Placental abruption can be categorized into mild and severe. In mild cases, maternal vital signs are normal with mild uterine tenderness with no or mild vaginal bleeding, and no coagulopathy. With severe cases, maternal hypotension or shock persists along with fetal distress, coagulopathy, and uterine pain/contractions, occurring with or without heavy vaginal bleeding.
2. What diagnostics should be obtained for this patient?
 - a. The diagnosis is made clinically. Fetal monitoring is sensitive for identifying fetal distress as a sign of placental abruption. Laboratory studies include CBC, metabolic panel, coagulation panel, fibrin degradation product, fibrinogen levels, and type and cross. Ultrasound to evaluate for placental abruption can be helpful; however, retroplacental bleeding is difficult to identify. A normal ultrasound should not provide absolute reassurance in the setting of high clinical suspicion.

Case 2: A 25-year-old G1 P0 at 35 weeks presents with abdominal pain after an MVC. On exam, she is immobilized with a cervical collar and backboard in the left lateral recumbent position. EMS reports that she is afebrile with HR 140 and BP 90/60. A seatbelt sign is present across a gravid abdomen. She does not think she has had any significant vaginal bleeding or fluid gush.

Question Prompts:

1. What monitoring is appropriate for this patient?
 - a. The first goal in treating the pregnant patient is stabilization and resuscitation of the mother. Although fetal loss rates are much higher in major trauma, minor injuries are more common such that the majority of fetal losses follow minor trauma. Fetal monitoring should be done as early as possible during the evaluation to assess for fetal distress.
2. Describe the initial management for this patient.
 - a. Remember to consider physiological changes of pregnancy when evaluating these patients. The patient is hypotensive. Blood pressure declines in first trimester, levels out in second trimester and returns to non-pregnant levels third trimester. Keep the patient on her left side to avoid supine hypotensive syndrome. Note that cardiac output can be augmented by placing the patient in left lateral decubitus position, if she is supine. In addition, this patient is very tachycardic. Placement of large bore IVs and resuscitation needs to begin as with all initial traumas. Laboratory studies including CBC, metabolic panel, coagulation panel, fibrin degradation product, fibrinogen levels, type and cross. Rhogam should be administered if patient is Rh negative. Obstetrics should be consulted and if possible present on patient



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- arrival to assess fetal condition immediately following primary survey and stabilization efforts for the patient.
3. Discuss various imaging modalities for this patient and which are appropriate at this time.
 - a. All diagnostic imaging utilized in the common initial evaluation of a traumatically injured patient falls below exposure levels associated with fetal anomaly or demise. Ultrasound can and should be completed. A FAST exam and assessment of intrauterine pregnancy (IUP) and fetal heart rate should be done. FAST exam in pregnant patients is similar to specificity in non-pregnant patients. However, pregnant patients do have a higher risk of retroperitoneal bleed, which is not well assessed on FAST. The use of ionizing radiation (CT and plain radiography) should not be withheld if it may provide significant diagnostic information. Nonionizing radiation, such as MRI, is preferred only if the patient is stable and if it is readily available.

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Appendix E: Ectopic Pregnancy and Fertility

Objectives

1. Identify the pathophysiology, risk factors, and important history and physical exam findings when evaluating potential ectopic pregnancy.
2. Critically discuss the use of serum quantitative human chorionic gonadotropin (hCG) and ultrasound in the diagnosis of ectopic pregnancy. When following down-trending hCG values, what level rules out ectopic?
3. Discuss management of patients with ectopic pregnancy including both well-appearing patients and unstable patients and determine the indications for medical vs surgical management of ectopic pregnancy.
4. Identify current infertility treatment options and potential complications.
5. Discuss the pathophysiology, risk factors, presentation, and management of ovarian hyperstimulation syndrome.

Case Studies

Case 1: 25-year-old female G3P2 presents with vomiting and abdominal pain. She had a recent miscarriage at an outside hospital, and her quantitative hCG dropped appropriately over 4 weeks. Last hCG was 50 approximately two weeks ago. Vitals: heart rate 98, blood pressure 95/63, respiratory rate 12, oxygen saturation 100% on room air.

Question Prompts:

1. What are the appropriate labs to order?
 - a. Check type and cross on any patient with concern for ectopic. Check quantitative hCG and complete blood count (CBC).
2. What level of quantitative hCG would indicate ectopic pregnancy is not possible in this patient?
 - a. Quantitative hCG is not a reliable indicator of risk for ectopic pregnancy with some case studies reporting a level in the 10-20 range.
3. You are at a small community hospital without obstetrics (OB). The patient's pressure drops and she becomes increasingly tachycardic. CT shows active bleeding in the right pelvis from presumed ruptured ectopic. How should you manage this patient? Should you transfer the patient to a facility with OB?
 - a. Ectopic pregnancy is the leading cause of first-trimester pregnancy related maternal deaths. If there is no option for obstetrics and gynecology (OBGYN) intervention, emergent general surgery consult should be considered for management of an unstable patient who is unable to safely transfer to another facility.



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Case 2: 38-year-old female G4P4 presents with abdominal pain and vaginal bleeding in between her normal menstrual cycle. She has had two prior vaginal births and two prior C-sections due to fetal distress. She had a tubal ligation performed after her last pregnancy two years prior. Her vitals are stable. Her urinalysis is consistent with UTI and her CBC and chemistry are unremarkable.

Question Prompts:

1. What are her risk factors for ectopic pregnancy? What else should you obtain during your history?
 - a. Risk factors for ectopic pregnancy include prior sexually transmitted infections (STIs), tubal ligation, assisted reproduction, prior pelvic surgeries, and prior ectopic pregnancy.
2. What is the most appropriate management for this patient if an ultrasound shows an ectopic pregnancy in the fallopian tube (medical vs. surgical management) and how would you decide this?
 - a. Clinically stable women with small (less than 3 cm) ectopic pregnancies and low hCG (less than 1500) should be given the choice between expectant, medical, and surgical treatment, depending on their personal preferences, perception of the risks associated with different management options, and their willingness to comply with follow-up visits.

Case 3: A 37-year-old woman with no prior pregnancies presents to the emergency department with a 20 pound weight gain in two days, headache, difficulty breathing and decreased urine output. Vital signs: Heart rate 110, respiratory rate 20, oxygen saturation of 100% on room air, blood pressure 90/55, temperature 98.8. She tells you that she has recently been undergoing injectable fertility treatments and has a history of polycystic ovarian syndrome (PCOS).

Question Prompts:

1. What is the pathophysiology of her symptoms? Contrast her symptoms to those of milder ovarian hyperstimulation due to oral medications or a milder reaction to intramuscular (IM) meds.
 - a. Classic physiologic changes of Ovarian hyperstimulation (OHSS) include arteriolar vasodilation and an increase in capillary permeability that results in fluid shifting from intravascular to extra-vascular spaces. This fluid shift results in a state of hypovolemic hyponatremia.
2. OHSS can occur from oral (PO) or IM treatment for infertility, but is more common with IM treatment. More severe symptoms include rapid weight gain, ascites, oliguria, tachypnea and hypotension (due to protein rich fluid shifts).
3. What are the risk factors for ovarian hyperstimulation syndrome?
 - a. Among women undergoing fertility treatment, younger age, black race, and history of PCOS may increase risk of OHSS.
4. What is your acute management of this patient?
 - a. Symptomatic moderate or severe OHSS is a hypovolemic hyponatremic state. Treatment of moderate or severe OHSS usually involves fluid replacement to maintain intravascular perfusion and supportive care. A rare but life-threatening risk for patients with severe



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hypovolemia involves arterial or venous thromboembolism; therefore, prophylactic anticoagulation is warranted in cases of severe OHSS from the time of diagnosis through the first trimester of pregnancy. Specialist outpatient management may involve paracentesis or culdocentesis.

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Appendix F: Spontaneous Abortion and RH Management

Objectives

1. Describe the diagnostic evaluation for a patient who presents with symptoms of threatened miscarriage.
2. Explain how spontaneous miscarriage is characterized based on findings in the emergency department (ED).
3. Articulate the treatment options for a patient diagnosed with inevitable or incomplete abortion.
4. Discuss the potential complications of pregnancy loss and the psychosocial needs of a patient with this presentation.

Case Studies

Case 1: 28-year-old female G3P0 present at six weeks gestation by last menstrual period (LMP). She complains of lower abdominal cramping and vaginal bleeding. She denies urinary symptoms. She has had two first trimester miscarriages and is worried that this is how her symptoms began when she had pregnancy loss. Vital signs: temperature 98.7 F, blood pressure 108/74, heart rate 84, respiratory rate 16, oxygen saturation 98% on room air.

Question Prompts:

1. What diagnostic testing should be obtained for this patient?
 - a. Initial laboratory testing should include a complete blood count (CBC) (to evaluate degree of blood loss), type and screen for Rh status, quantitative serum human chorionic gonadotropin (hCG), and urinalysis. Additional diagnostic testing should include an ultrasound to confirm intrauterine pregnancy and obtain cardiac activity if possible.
2. How is spontaneous abortion characterized based on findings in the ED?
 - a. Threatened abortion: a pregnancy complicated by bleeding before 20 weeks' gestation
 - b. Complete abortion: all products of conception have been passed without the need for surgical or medical intervention
 - c. Incomplete abortion: some, but not all, of the products of conception have been passed; retained products may be part of the fetus, placenta, or membranes
 - d. Inevitable abortion: the cervix has dilated, but the products of conception have not been expelled
 - e. Recurrent spontaneous abortion: three or more consecutive pregnancy losses (indication for referral for testing for underlying cause of miscarriage)
3. How should this patient be managed?



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- a. Management is dependent on the patient's presentation and hemodynamics. Placement of intravenous (IV) lines and resuscitation may be necessary in an unstable patient. Treatment options for incomplete or inevitable miscarriage include expectant management or medical management with misoprostol (approx. 80% success rate). Hemodynamically unstable patients, later gestational age, or those who fail expectant or medical management should be offered dilation and curettage (D&C). Patients who are Rh(D) negative and unsensitized should receive 50 micrograms of Rh(D)-immune globulin immediately after surgical management of early pregnancy loss or within 72 hours of the diagnosis of early pregnancy loss with planned medical management or expectant management in the first trimester. For Rh negative patients administer 50 micrograms of Rhogam in first trimester and 300 micrograms in second and third trimesters.
4. How should the patient be counseled if discharged with threatened or inevitable abortion?
 - a. The patient should be given careful return precautions with regard to symptoms of hemodynamic instability or progressive pain or bleeding. Depending on ultrasound findings at presentation, she may need continued obstetrics follow-up with sonographic evaluation and serial hCG measurements. While in the ED, patient education and support should be provided. Patient should be advised that moderate activities do not affect the pregnancy. Tampons, intercourse and other activities that might induce uterine infection should be avoided as long as patient is bleeding.
5. What are potential complications of spontaneous abortion? Describe the psychosocial considerations in the management of this patient.
 - a. Acute Hemorrhage
 - b. Rh Incompatibility- For Rh negative patients administer 50 micrograms of Rhogam in first trimester and 300 micrograms in second and third trimester
 - c. Septic abortion (a spontaneous abortion that is complicated by intrauterine infection)
 - d. Miscarriages are associated with a significant grieving process. It is important to reassure women that they have done nothing to cause miscarriage and that it occurs in a significant number of pregnancies (approx. 50% attributed to chromosomal abnormalities) and does not imply that future miscarriages will occur. Additionally, it is important to counsel patients that the term "abortion" is a medical term for miscarriage as some patients may not understand this term on their discharge paperwork or in their medical chart.

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Appendix G: Preeclampsia, Eclampsia, and HELLP Syndrome

Objectives

1. Review diagnosis and treatment of pre-eclampsia, eclampsia, and HELLP syndrome
2. Critically discuss the management of hypertension in pregnancy
3. Review the role of magnesium and steroid administration for eclampsia

Case Studies

Case 1: A 40-year-old female is brought in by ambulance with her husband after she had a witnessed “seizure.” No history of prior seizure. She has a past medical history of hypertension and is G1P1, seven days post-partum from Normal Spontaneous Vaginal Delivery (NSVD). She was given Versed by medics prior to arrival, which stopped her seizure. Vitals: blood pressure 180/104, heart rate 90, respiratory rate 16, oxygen saturation 98% on room air. The patient is drowsy, but is arousable and responds appropriately. There are no focal deficits on neurologic exam.

Question Prompts:

1. What are her risk factors for eclampsia? How is preeclampsia diagnosed?
 - a. Risk factors for eclampsia include extremes of age (less than 20 yrs, greater than 35 yrs), multiple gestations, first pregnancy, and history of obesity, hypertension, and diabetes.
 - b. The pathophysiology of preeclampsia is poorly understood. Preeclampsia is defined as blood pressure 140 mm Hg or higher systolic or 90 mm Hg or higher diastolic after 20 weeks of gestation in a woman with previously normal blood pressure, and proteinuria with 0.3 g or more of protein in a 24-hour urine collection (typically corresponds with 1+ or greater on urine dip). Severe preeclampsia is defined by blood pressure 160 mm Hg or higher systolic or 110 mm Hg or higher diastolic on two occasions at least six hours apart and proteinuria with 5 g or more of protein in a 24-hour urine collection or 3+ or greater on urine dip of two random samples collected at least four hours apart.
2. What diagnostic testing should be ordered?
 - a. The following labs should be ordered: complete blood count (CBC) (to assess hemolysis and platelets, peripheral smear may assess for schistocytes), liver function tests (LFTs), renal function tests, coagulation profile, lactate dehydrogenase, uric acid, urinalysis to assess proteinuria.
3. What is your initial management of this patient?



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- a. Eclampsia should be suspected in any pregnant woman greater than 20 weeks of gestation or less than 4 weeks postpartum who develop seizures, coma or encephalopathy. Seizure may occur with or without hypertension or proteinuria. When managing a patient, airway, breathing and circulation (ABCs) are of primary importance. Intravenous (IV) access should be obtained and the patient should be placed on the cardiac monitor. A foley should be placed to monitor urine output. Magnesium sulfate should be initiated with a loading dose of 4-6 g IV over 10-15 minutes, then IV infusion 1-2 g/hr. Monitor for magnesium toxicity (respiratory depression, bradyarrhythmia, loss of deep tendon reflexes). The antidote is 1 g IV calcium gluconate. Start appropriate blood pressure control with labetalol and/or hydralazine. Obstetrics consultation should be obtained for emergent delivery if still pregnant or admission and monitoring if post-partum.
- b. Note: If this patient was still pregnant, avoid angiotensin converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) due to risk of malformation (oligohydramnios, intrauterine growth restriction (IUGR), and pulmonary hypoplasia).

Case 2: A 38-year-old female G3P2 at 28 weeks gestation who is being monitored for borderline hypertension by her OB presents with abdominal pain, worse in the right upper quadrant. Platelets are 100, aspartate transaminase (AST) 800, alanine transaminase (ALT) 650. She is a little more “out of it” per her husband.

Question Prompts:

1. What are the patient’s risk factors for HELLP (hemolysis, elevated liver enzymes, low platelet count)?
 - a. Risk factors include multigravida, maternal age over 25, white race, history of preeclampsia or pregnancy-induced hypertension, history of previous pregnancy with HELLP syndrome (19%-27% chance of recurrence in subsequent pregnancies).
2. What is your initial management of this patient?
 - a. Resuscitation and fetal monitoring are imperative. Control blood pressure with IV labetalol and/or hydralazine. Magnesium sulfate IV for seizure prophylaxis. Platelet transfusion should be pursued if the platelet count is less than 20,000. Corticosteroid (betamethasone or dexamethasone) administration can help delay delivery and improve fetal outcome if gestation is less than 34 weeks. Steroid administration helps improve fetal lung maturity and surfactant production. Delivery is the definitive treatment.
3. What are potential complications of this patient’s condition?
 - a. This patient is at risk for serious complications including spontaneous hepatic and splenic hemorrhage, eclampsia, end organ failure, intracerebral hemorrhage, disseminated intravascular coagulation (DIC), placental abruption, maternal and fetal death.



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