

“My Belly Hurts”: Approaching Abdominal Pain in the Pregnant Patient

Problem Based Learning Case

Facilitator’s Guide

Reflection Trigger (30-40min)

Notes: Use this question to get students engaged and discussing their own clinical experiences with patients. Most students will automatically think of the “intimate” exams such as GU, rectal, pelvic and breast exams. However, discussion of any of the aspect of the exam is acceptable. In fact, if students wish to discuss any aspect of patient interactions that made them uncomfortable, it is also acceptable.

Question (Use presentation slide):

Think of a time where some aspect of the physical exam has made you or the patient uncomfortable. What were your thoughts, and how did you react?

Part I. Meeting The Patient

HPI

Notes: This will be conducted in “morning report” style. You can provide the first line that is underlined (Also presented on HPI slide). Let students ask questions. Have a scribe keep track of the important data on the board. Students may ask questions about PMH, PSH, and MEDs and pregnancy history here too. Be aware that there will be a more detailed discussion of the current pregnancy soon, so defer those questions for later (ex. “We will talk about the current pregnancy at length shortly.”). Use HPI slide as a check to summarize highlights after students are done.

Case:

Patient is a 20yo G2P1001 at 27w4d who presents with abdominal pain for 2 days. Pain **came on quickly, is severe, and is diffuse** but **worst in the RLQ**. It hurts when the baby moves. She notes a **temperature of 101.5°F at home and chills**. She notes **nausea and vomiting**, and has been unable to keep down fluids on the day of presentation. She also has **back pain** that began around the same time as the abdominal pain. Pain is **not** exacerbated by urination. Patient notes **slightly increased urinary frequency** with **urgency** and occasional **dysuria**. She denies gross hematuria. Patient also notes an intense throbbing headache of new onset, lightheadedness, and increased thirst.

Patient notes no vaginal bleeding, no discharge, no contractions/cramps, and normal fetal movement.

PMH: None **PSH:** None **Alg:** None **Meds:** Ferrous Sulfate, Vitamin

HPI at a Glance	
Admits	Denies
<ul style="list-style-type: none"> • pain- severe, quick onset, diffuse but worse in RLQ, hurts when baby moves, nothing improves. Back pain also began at same time. • fevers (101.5°F) & chills • nausea/vomiting-- cannot tolerate fluids today • mildly increase urinary frequency • urgency • dysuria- "sometimes nothing comes out" • throbbing headache • new lightheadedness • very thirsty • typical fetal movements • sore throat • recent onset shortness of breath 	<ul style="list-style-type: none"> • pain with urination • hematuria • vaginal bleeding or discharge • contractions/cramps. • If not listed here or in slides, assume patient denies.

Pregnancy History in our Patient:

Notes: This section features the first area of "teaching." Here students will review the typical prenatal labs and studies. Use history gathering about the patient's current pregnancy as a platform to challenge students to discuss what labs are to be expected for our patient. The presentation slide prompts students with the initial question. Use the directions and chart in the "Questions and Background" section to direct and support the discussion.

Case:

First pregnancy: uncomplicated, baby delivered at term by spontaneous vaginal delivery (SVD).

Current pregnancy: complicated by *Klebsiella* UTI at 16 weeks with negative test of cure (TOC) at 25 weeks.

Questions and Background

1. ***The senior resident asks "What routine prenatal labs and studies would you expect to find in the chart for the patient since she is at 27 weeks of pregnancy?"*** Here we ask students to anticipate the typical prenatal studies that this patient should have on record based on her weeks of gestation and the assumption that she has been receiving regular prenatal care. Have students, as best they can, list which labs/studies they would expect and roughly when during pregnancy the lab should be done (drawing a table on board would be great). Challenge students to explain the purpose of the labs.

Use the table below to support the group by answering questions, or mentioning overlooked studies. **On the presentation-** The next slide after the resident's question provides the appropriate studies and another click displays our patient's results for these studies.

Study	Purpose	Timing	Notes
blood type and screen	Detect antibody (Ab) that could lead to hemolytic disease of newborn. Transfusions may be needed for delivery/surgical complications.	Initial visit	Rh(D) “-“ woman require Anti-(D) immunoglobulin (RhoGAMM) at 28wks
CBC	Looking for anemia.	Initial visit	Findings suggestive of thalassemia can be pursued with electrophoresis
rubella immunity Ab titer	Detect TORCH infection.	Initial visit	If nonimmune, should be immunized AFTER pregnancy
STI's syphilis-VDRL/RPR gonorrhea/Chlamydia HIV hepB	Prevent perinatal transmission	Initial visit	ACOG recommends universal HIV screening with opt-out approach. Perinatal transmission can be reduced from 15-40 to <2% with anti-retrovirals and avoiding labor/breast feeding
urinalysis/urine culture	Detection of UTI, which can lead to further complications.	Initial visit	This will be more extensively covered in remainder of case
TSH*	Diagnose thyroid disorder in mother. Maternal thyroid disorder can complicate pregnancy and lead to congenital disorder in child.	Initial visit	*ACOG, American Thyroid Association, Endocrine Society recommend only for patients who are symptomatic
Tay-Sachs, CF, sickle cell	Screen for genetic disorder in at risk populations	Initial visit	
dating US	Determine an accurate gestational age	Initial visit	Dating by US is most accurate in the first trimester when growth and development is more standard.
triple screen – PAPP A, free Beta hCG, nuchal transparency US.	Screening for presence of trisomy 21 and 18. Can be offered to low risk woman.	First Trimester 9-14wks	This is an optional screen. CVS would be the follow up diagnostic for this screen. 10-12Wk.
quad screen/MSAFP AFP, estriol, b-hCG, inhibin A	Screening for trisomy 21 and 18	Second Trimester 15-20wks	Amniocentesis would be diagnostic to follow up this screen.
anatomic US	More complete US survey of fetal anatomy	Wks 18-20	
glucose tolerance test	Screen for gestational diabetes	Wk 24-28	

2. **What routine labs/studies will the patient have in the remainder of her pregnancy as a part of prenatal care?** Here we ask students to complete the studies/lab timeline for our patient until to her delivery date assuming that the pregnancy is unremarkable.

Study	Purpose	Timing	Notes
CBC	Assess for anemia	Early 3 rd Trimester	Iron requirements increase during pregnancy which could lead to anemia
GBS culture	Screen for colonization of Group B Strep	Wks 35-36	The women are treated as if infected. Intrapartum antibiotics required.
*STI screening	Detect STI for prevention of perinatal transmission	Late 3 rd Trimester	*only in patients who are at risk or had positive screen earlier this pregnancy. Pregnant women have same risk for STIs as nonpregnant women.

Adapted from: Lockwood C, Magriples U. The initial prenatal assessment and routine prenatal care. UpToDate [Internet]. [modified 2012 Mar 6; cited 2012 Mar 20]. Available from: www.uptodate.com

Our patient's labs thus far in pregnancy

- O+ blood type, Ab's negative
- VDRL/HIV/GC/Chlamydia/HepB negative
- Hct 30.4
- CF negative
- Rubella immune in 2009
- Quad screen low risk
- Glucola 89
- Ultrasound Studies unremarkable

Considering Abdominal Pain in Pregnancy

Notes

This slide is intended to set students up to begin thinking about the differential diagnosis of abdominal (Abd) pain in pregnancy. Some brief information is provided to frame the thought process regarding the etiologies of abd pain in this patient population.

Differential Diagnosis

Notes:

Using a white board, students will generate “buckets” and put the items on their differential diagnosis into those groups. “Buckets” are large categories that can reasonably divide diseases by pathology or anatomy. Examples of buckets include, but are not limited to, “pulmonary”, “cardiovascular”, “autoimmune”, “infectious”, “obstetric”, and “neoplasm.” Conditions should be listed in these categories. Some conditions could go into multiple “buckets”. Putting these conditions in one reasonable location is acceptable. For example, chorioamnionitis could reasonably be placed in either “obstetric” or “infectious.” Any method can be used for generating a differential and the above mentioned process is simply a suggestion. Acknowledge that students do not have a physical exam or labs to assist their differential generation. This information will come later and will be used to revise the differential. It may be helpful to review the HPI and other history to help students develop this list.

ABD Pain During Pregnancy at a Glance	
Below are brief descriptions of many causes of abdominal pain in the pregnant patient. The point of this table is not to suggest that all of the conditions included are likely for this patient, but to provide information about conditions that students may discuss as they generate their differential	
Non OB/GYN causes of ABD pain*	
<ul style="list-style-type: none"> • Appendicitis: Most common non-obstetric surgical cause of abd pain. Frequently delayed diagnosis because nausea, vomiting, abd pain are common in pregnancy. RLQ pain is most reliable symptom, but appendix can be displaced superiorly beginning around wk 12. • Cholecystitis: Similar presentation to non pregnant women. 90% associated with stones with pregnancy being a risk factor for stone formation. Murphy’s sign less common in pregnant patient. US still effective imaging study. • Bowel Obstruction: More common in 2nd/3rd trimester as uterus grows in Abd cavity. Presents with crampy pain, obstipation, and vomiting. Adhesions and volvulus are most common causes. Be suspicious of patient with hyperemesis gravidarum in 2nd/3rd trimester with abd pain. N/V+ abd pain should raise concern about less benign condition. 	<ul style="list-style-type: none"> • Acute Pancreatitis: Presents similarly to non pregnant women. “Fetal Position,” epigastric pain that radiates to back, pain relieved by leaning forward, fever, postprandial nausea and vomiting. Again, most likely due to gall stones. • Inflammatory Bowel Disease: Look for associated loose & bloody stools, fever, weight loss. • Peptic Ulcer Disease • Perforated Ulcer: Sudden onset of diffuse abd pain with history of PUD. Peritoneal signs develop over 12 hrs. • Nephrolithiasis: Flank pain that may radiate to groin. Usually 2nd or 3rd trimester. Hematuria. Fever is UTI is present. • Urinary Tract Infections • Gastroenteritis/Mesenteric Adenitis: Can cause severe abdominal pain • Splenic Artery Rupture: Signet ring calcification on Abd X-ray suggest splenic artery aneurism • Pneumonia: Abd pain can occasionally be only symptom of lower lobe disease. • Sickle Cell Crisis • Severe Vomiting: Can lead to muscle ache. Pain in upper abd without distinct mass. Hospitalize for fluids and anti-emetics. Pain should diminish after treatment.

OB/GYN causes of ABD pain*

Etiologies organized roughly by timing of presentation during pregnancy. The divisions do not suggest exclusivity in timing, but only increased likelihood. "Early" refers to first 20 weeks. "Late" refers to last 20 weeks.

<p>Early</p> <ul style="list-style-type: none"> • Always consider preterm/term labor!! • Miscarriage: Crampy midline pelvic pain with vaginal bleeding. Pain arises as uterus squeezes clots through cervical os. <20 wks. • Fibroid: More common in patients aged 30-40, between wk 12-18. Presents with localized pain that may be associated with fever, nausea, and vomiting. Pain can mimic appendicitis in RLQ. • Ectopic Pregnancy: Rupture of pregnancy is emergency. Nontubal pregnancies may not present until 2nd, or even 3rd trimester, while tubals are early. Present with pelvic pain, bleeding, nausea, vomiting. Extrauterine and intrauterine pregnancies can occur together. • Ovarian Torsion: Presents in pregnancy and non-pregnancy in similar ways. Often sudden onset of lateralized Abd pain, nausea, vomiting, leukocytosis. Ultrasound is useful imaging. In order to preserve ovary, surgery should not be delayed. • Pelvic inflammatory disease: rare 	<p>Late</p> <ul style="list-style-type: none"> • Abruptio Placentae: Presents with ABD pain, with vaginal bleeding, contractions, nonreassuring fetal status and possibly back pain. This is an emergency, and delivery is indicated. • Uterine Rupture: Presents with uterine tenderness, peritoneal irritation, nonreassuring fetal status or fetal demise, vaginal bleeding. Usually in laboring patients with past history of uterine surgery of c-section. Rupture otherwise can occur after trauma. • Severe Preeclampsia/HELLP Syndrome: Hemolysis, Elevated Liver enzymes, and Low Platelettes. Presents with pain in mid epigastric, RUQ or inferior to sternum, nausea, vomiting. Hypertension and proteinuria present in majority of these patients. • Acute Fatty Liver: Typically presents in 3rd trimester with nausea, vomiting, epigastric pain, jaundice, anorexia. Many of these patients demonstrate signs and symptoms of preeclampsia during the course of disease. • Chorioamnionitis: Common in setting of premature rupture of membranes. Presents with fever, uterine tenderness, contractions, maternal and fetal tachycardia, foul smelling vaginal discharge. • Round Ligament Pain: Stretch placed on ligament as uterus grows. Exam reveals tenderness localized to round ligament that may radiate to pubic symphysis.
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*Table information adapted from following sources:

- Kilpatrick C, Orejuela F. Approach to abdominal pain and the acute abdomen in pregnant and postpartum Women. UpToDate [Internet]. 2012 Feb 15 [cited 2012 Feb 20]. Available from: www.uptodate.com
- Rogers V, Worley K. CURRENT Medical Diagnosis & Treatment 2012. Ed. McPhee S. Access Medicine [Internet]. 2012 [cited 2012 May]. Chapter 19: Obstetrics and obstetric disorders. Available from: <http://www.accessmedicine.com>
- Sharp H. The acute abdomen during pregnancy. Clinical Obstetrics and Gynecology. 2002;45(2):405–413.
- Stone K. Acute abdominal emergencies associated with pregnancy. Clinical Obstetrics and Gynecology. 2002;45(2):553–561.

Move on to the tiered differential when you and students feel the activity completed to your satisfaction.

Tiered Differential Diagnosis

Notes

During the preceding portions, students created a differential. Now, we ask students to organize their thinking into urgency of disease. This reflects the common thought process clinical practitioners use to assess a patient's condition. Often health care practitioners look to rule out immediately threatening conditions, while considering much more common diseases that fit the clinical picture of the patient.

Directions:

1. Ask students to organize their differential into three categories: Disease that is threatening to the life of mom or fetus, disease that is more likely and less threatening, and disease that is less likely but should be considered. Urge students to brainstorm **2-4** conditions under each heading drawing from the original differential.

Examples of prompting questions:

- “Which of the listed conditions are urgent or emergent and threaten the wellbeing of the mother or the fetus?”
 - “Which of the conditions are common but typically less urgent for the mother and fetus?”
 - “Which of the conditions are less likely but still worth keeping in mind at this point?”
2. As a part of this exercise, students should verbalize their thought process for categorizing diseases.
 3. After students finish, show the slide depicting the tiered differential. The differential included in the presentation **is not meant to be totally inclusive**, but is representative of the urgency of various disease processes

Physical Exam

Notes:

Physical Exam may also be done in “morning report” style, with students asking for specific parts of the exam. Use the presentation slide after students are done to summarize highlights. Alternatively, you may reveal the exam to students. If some students are confused about certain aspects of exam findings, encourage other students to explain meaning of values/findings.

Physical Exam	
Assume findings not given here are negative or benign	
<p>Vitals: T 98.9°F BP 88/56 HR 109bpm RR 20bpm SpO2 99% on room air</p> <p>GEN: NAD</p> <p>CV: tachycardic, regular rhythm.</p> <p>Lungs: Clear to auscultation bilaterally.</p> <p>Abd: Soft, gravid, mildly tender in suprapubic and fundal regions with deep palpation. No RUQ tenderness to palpation.</p> <p>Back: Bilateral tenderness, lower than CVA</p>	<p>Ext: no edema, nontender. 2+ distal pulses</p> <p>Neuro: DTR 2+ bilaterally in all fields</p> <p>SVE: no lesions. 1cm/30% effaced/-2 station. Tender to palpation of anterior, posterior, and right fornices.</p> <p>SSE: No pool, negative valsalva, normal discharge, no lesions</p> <p>Non-stress test: FHR: 170 baseline, otherwise reassuring. No contractions on TOCO.</p>

Labs/Studies

Notes:

This section invites students to propose studies they would order for the patient. This section will also take time to review UAs and urine cultures for the purposes of diagnosing UTI. Initially, let students suggest studies and supporting rationale for each study. When all reasonable suggestions have been fielded, use the UA as transition to this “teaching topic”.

Directions:

1. Ask students what studies they would order for this patient and supporting rationale.
2. Most likely the group will suggest UA, which is transition into next teaching topic.

Labs included in this Case:

- Complete Blood Count
- Liver Function Tests: AST/ALT, Alkaline phosphatase, Bilirubin
- Basic Metabolic Panel: Electrolytes and Blood Sugar
- Urine Analysis and Urine Culture

UA and Urine Culture

Notes:

These presentation slides are numbered in this section. The number appearing before the title of the slide indicates the **number only the number within this section** (not number within the entire presentation). Information is present on the slides. Clicking the mouse progresses through the bullets on the slides.

Directions:

Student most likely will include UA/urine culture in the discussion of lab workup for the patient. A urinalysis can provide a lot of information, but the point of this section is to review how UA's and urine cultures should be used to diagnose a UTI. There is a review of some of the basic science behind elements of the UA.

1. **Slide 1** asks: "What are the components of a UA?" Here students are simply encouraged to list the components of UA to help.
2. **Slide 2** lists most of the common components of the UA along with normal values. The point is not to dwell here, but to help students focus on the UA.
3. **Slide 3** begins by explaining that when looking for UTI, we are looking for evidence of bacteria and immune response within the urine specimen. **Clicking further** brings up aspects found on urine **dipstick** indicating bacteria and WBC response: leukocyte esterase and nitrites. Supporting information follows.
4. **Slide 4** attempts to inform students about how to interpret results. Positive results for one or both parameters support the diagnosis of UTI. Finding negative results for these parameters do not rule out the presence of UTI. After this concept, some scenarios of misleading results are discussed. During that discussion, some terms are used which are defined below:

*Notes on slide:

"False positive" is used to describe a diagnostic test result in which a patient tests positive for disease though, in fact, the patient has no disease. Here, the presence of leukocyte esterase is used to aid in diagnosis of a UTI. However, a patient can be positive for leukocyte esterase though the patient has no UTI. The example given here is the presence of the vaginal contaminant *Trichomonas*, which can produce detectable esterase though the patient has no UTI.

"False negative" is used to describe a diagnostic test result in which a patient tests negative for a disease though, in fact, the patient has disease. Two examples are present on the slide. First, the term is used in relation to leukocyte esterase. In the early stages of a UTI, the immune response may not be robust enough to produce enzyme at a quantity detectable by the dipstick, leading to a negative result though an infection is present. Next, the term is used in relation to nitrites. A negative nitrite result will be

found in a patient with a UTI caused by the organisms that do not convert nitrates to nitrites. So here, infection is present though the result is negative.

Definitions for “false negative” and “false positive” adapted from:

Duleba A, Mahutte N. Evaluating diagnostic tests. UpToDate [Internet]. 2012 Apr 5. [Cited 2013 June 2]. Available from: www.uptodate.com

5. **Slide 5** opens by indicating that this slide talks about microanalysis of urine in hopes of finding evidence of bacteria and WBC. This is microscopic examination of a urine sample. **Clicking** brings up discussion of bacteria, WBCs and cautions. **When discussing cautions**, ask student to offer suggestions as to why the listed factor may interfere with testing.
 - a. **For ex.**, “*Why does high fluid intake interfere with microanalysis?*” **Answer:** dilution of urine masks real concentration of bacteria/WBC in UT.
 - b. **Self medicating:** Could be partially treating UTI with old antibiotics
 - c. **Leucopenia:** Systemic low WBC count leads to low WBC count in urine even in presence of UTI
 - d. **First void:** Bacteria have had chance to grow overnight in bladder. First void is also best for other aspects of UA in detecting UTI (nitrates, leukocyte esterase), but impractical for the majority of patients.
6. **Slide 6** opens by stating the urine culture is the gold standard for diagnosing UTI. **Clicking once**, brings up banner about collecting urine. Included below is a definition of a positive urine culture.

Positive Urine Culture: A widely accepted standard of a positive urine culture is one with the presence of at least 10^5 CFU(colony forming unites)/ml of urine. This cut off is for clean catch specimens. Should the urine be collected via catheterization or suprapubic aspiration then as little as 10^2 CFU/ml of urine is the cut off. It’s interesting to note that between 20% to 40% of women with cystitis will have cultures only yielding 10^2 to 10^4 cfu/ml with clean catch specimens.

Definition adapted from:

Dielubanza, & Schaffer. Urinary tract infection in women. Med Clin N Am 95 (2011) 27–41
Tintinell’s Emergency Medicine. Accessed via Access Medicine 2/12

- a. **At this point ask students** “How would you describe to a patient the proper technique for a urine specimen collection?” **Elements of response should include:** wipe meatus with disinfectant and dry, both steps are front to back motion; spread labia; initial void is not collected; second void is collected (this represents urine in bladder and in upper UT). **Next click** brings up more info about the “clean catch method.”
- b. **Ask students**, why sample needs to be processed in timely manner. **Answer:** “the longer the sample sits, the more the bacteria multiply, making study less accurate.”

Labs:

This slide brings us back to the case by showing the lab results of the actual patient. Let students take this in for a few moments. **Ask students:** “What studies are remarkable and why?”

Parameter	Abnormal Value
Complete Blood Count (CBC)	<ul style="list-style-type: none">• WBC: 18.5, elevated• Hemoglobin 9.0, low• Hematocrit 26%, Low
Urinalysis (UA) The abnormal values found in this study highly support a diagnosis of a urinary tract infection. The type of UTI is supported by clinical presentation of patient.	<ul style="list-style-type: none">• Leukocyte Esterase: (+)• Nitrite: (+)• WBC: 30-100• Bacteria: Many• *Low squamous cell count means sample probably not contaminated.

Diagnosis:

Come back to our DDX. What do we think is now the most likely cause of our patient’s condition? **Answer:** This patient is suffering from **acute pyelonephritis**.

Part 2. Caring for the Patient

Pyelonephritis in Pregnancy

Directions:

Begin by **asking students** to define pyelonephritis as they understand it.

Show “Pyelonephritis overview” slide. There is one click to display all information.

Discussion points for basic science of pyelonephritis, presented in an order following along with the presentation:

1. Show “Epidemiology” Slides 1 & 2
 - a. These two slides feature 3 questions about some basic epidemiology of acute pyelonephritis. Each question should be thrown to students for brief responses. **A click** will display the answering information.

2. Show “Pregnancy as a Risk Factor for UTI” slide.
 - a. “Why is pyelonephritis more common in pregnancy than in the general population?”
 - b. The authors suggest thinking of UTI risk during pregnancy through paradigm of “urinary stasis + bacterial proliferation = increased infection risk”
 - c. Challenge students to create a table/diagram depicting the effects of pregnancy on the kidney/ureter/bladder (An example of the table is present in the presentation). **The slide details** physiological changes in to the urinary tract that increases the risk of UTIs.

Asymptomatic Bacteriuria

Notes:

This is another “teaching topic.” The presentation slides will guide you. The steps below contain brief notes about each slide. Note that each slide title is numbered by their order within this section, not the by location within the entire presentation.

1. **Slide 1: Let’s Take A Step Back**, sets the stage of a similar patient with similar labs but with **NO** symptoms. This is asymptomatic bacteriuria, which is technically defined below:

asymptomatic bacteriuria (ASB)- “isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen from an individual without symptoms or signs of urinary tract infection”**

foot note from slide:

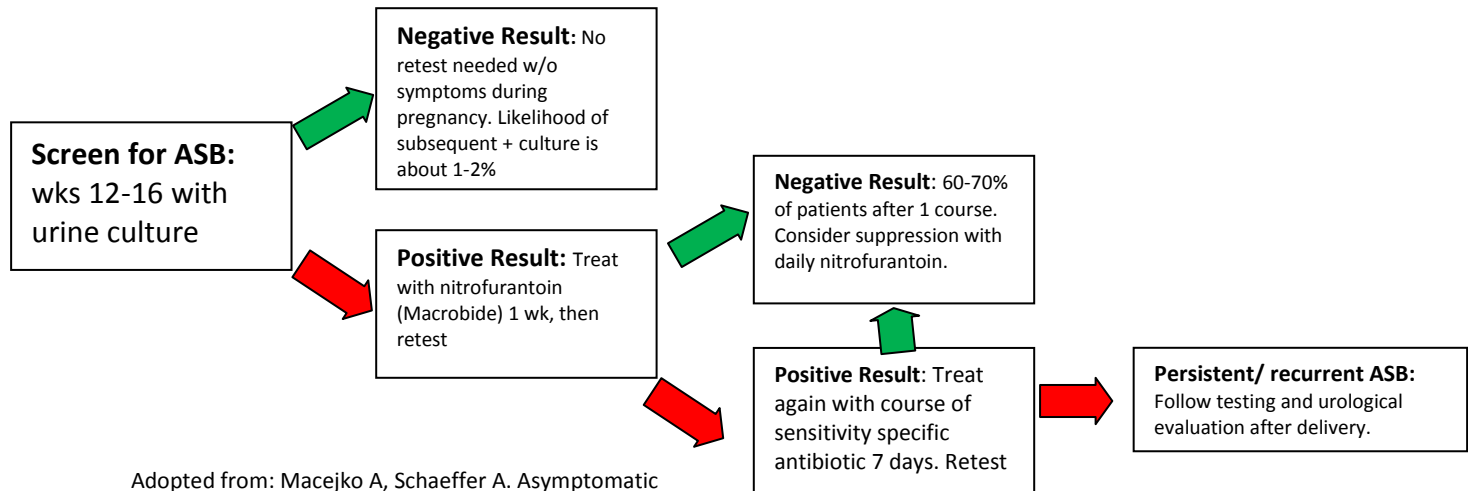
2. **Slide 2:** Defines ASB. 4-6% of all woman—pregnant and nonpregnant alike. Rates are similar between the two groups.
3. **Slide 3:** Informs students about the pertinence of ASB in the pregnant patient.

foot note from slide:

**Other patients with ASB who need treatment: hip arthroplasty patients prior to procedure who will have Foley postoperatively; patients who will undergo urological intervention where mucosal bleeding will occur.*

4. **Slide 4:** Next slide is a summary of recommendations of USPSTF regarding screening for ABS. **Notice** the **grade is A** and recommends screening of all pregnant woman between **weeks 12-16**.
5. **Slide 5:** Diagrams the algorithm for managing ASB in pregnancy. Below is a reproduction of the chart. The slide itself requires you to click to progress along the scheme.

**Fekete, T & Hooton, T. “Approach to the adult with asymptomatic bacteriuria.” Accessed on UPTODATE. Last updated 4/5/2012. Accessed 5/20/2012. Available: www.uptodate.com



Adopted from: Macejko A, Schaeffer A. Asymptomatic Bacteriuria and symptomatic urinary tract infections during pregnancy. *Urology Clinics of N. America.* 2007;34: 35–42.

Back to the Patient and Pyelonephritis

Notes:

The remaining slides lead students through diagnosis information about pyelonephritis. Use the prompting questions provided in the guide/slides. The presentation can support group discussion.

1. What are the signs and symptoms of pyelonephritis? **Answer on slide.**
2. What labs are used to diagnose pyelonephritis? **Answer on slide.**
3. What imaging is helpful? Do we routinely image patients with suspected pyelonephritis? **Answer on slide.**
 - a. Show slides with CT images and U/S image.
 - b. **See Tables Below for notes about radiographic imaging in pregnancy.** This is only to support questions that may arise in discussion and is not central to case.
3. Management: Ask the students, “Should our patient be cared for on an inpatient or outpatient basis?” **Answer: In patient.** Remember our patient is hypotensive, tachycardic with fever and severe pain. She is unstable. Though she is not in preterm labor. She needs to be treated and monitored on inpatient basis.
4. “Treatment” slides
 - a. Inpatient → improvement → outpatient → prophylaxis
 - b. **See Large Table on following page about antibiotics in pregnancy,** should student have questions.
5. Ask students “What are the complications of pyelonephritis?”
 - a. Show the complications slide
 - b. Table of complications: **Note** that preterm labor **IS NOT** greater in this population than that of the general obstetric population.

Concern about Radiographic Imaging in Pregnancy*

- Accepted dose of radiation to fetus during entire pregnancy= 5cGy
 - Centigray (cGy) = 1/100 Gray= 1 rad.
Unit of absorbed radiation
- Radiation associated with congenital malformation > 10 cGy
- Perinatal radiation linked to blood malignancies
- Fetus most vulnerable from implantation to about 15wks. Organogenesis occurs in that time
- MRI has no ionizing radiation. Risk Unknown
- Iodide contrast for CT merits thyroid evaluation of newborn.
- Table shows most studies within limits, but use with prudence

Imaging Study	Estimated Radiation Exposure to Fetus (cGy)
Two view chest X-ray	0.00007
C-spine X-ray	0.002
Pelvis x-ray	0.04
Upper GI series	0.056
HIDA scanning	0.150
CT of abdomen	2.60
Barium Enema	3.986

Beery P, Ellison EC, Mikami D. Sabiston Textbook of Surgery. 19th ed. Ed Beauchamp RD, Evers BM, Mattox KL, Townsend C. MDConsult [Internet]. 2012 [cited 2012 June 2]. Chapter 72, Surgery in the Pregnant Patient. Available from: www.accessmedicine.com

Students may have questions about the usage and safety of antibiotics during pregnancy. The case focuses on the drugs specifically for pyelonephritis, ASB and prophylaxis. However the table below may be helpful as students discuss treatment.

Antibiotic Safety in Pregnancy	Drugs	Notes
Safe in pregnancy	<ol style="list-style-type: none"> 1. 1.Penicillins -Pen G, Amp, Amox 2. 2.Cephalosporins 3. 3.Clindamycin 	<ol style="list-style-type: none"> 1. 1.PenG used for GBS bacteriuria treatment 2. 3.Clindamycin used for GBS for pen allergic patients
Use with Caution	<ol style="list-style-type: none"> 1. Nitrofurantoin 2. Aminoglycosides 3. Sulfisoxazole 4. Trimethorpim 	<ol style="list-style-type: none"> 1. May put at risk of fetal hemolytic anemia if mom G6PD deficient 2. Possible risk of oto/nephrotoxicity 3. Antifolate, which may lead to NT defects in 1st trimester. May lead to hyperbilirubinemia in 3rd trimester. 4. Antifolate, may lead to NT defects in 1st trimester.
Avoid in pregnancy	<ol style="list-style-type: none"> 1. Fluoroquinolones 2. Chloramphenicol 3. Erythromycin 4. Tetracycline 	<ol style="list-style-type: none"> 1. Arthropathy in animal models 2. grey baby syndrome 4. deciduous teeth discoloration

Adapted from: Macejko A, Schaeffer A. Asymptomatic Bacteriuria and symptomatic urinary tract infections during pregnancy. *Urology Clinics of N. America.* 2007;34: 35–42. **With Data originally appearing:** Schaeffer AJ. *Campbell’s Urology.* 8th ed. Ed. Walsh PC, Retik AB, Vaughan ED Jr. Philadelphia: WB Saunders; c2002. *Infections of the urinary tract.* p. 516–602

More about the Patient

Notes

The presentations will lead the way. Here we return to the story of our patient who initially presented. The patient's stay is complicated by septic shock. This is a brief opportunity to review the SIRS—sepsis spectrum. This full scope of managing sepsis is beyond this case, but the condition is important here as it is a significant complication of pyelonephritis. On the septic shock page, ask the students:

- What are the SIRS criteria?
 - o **2 or more of the following: Temperature > 38.5°C or <35.0°C, Heart Rate > 90 bpm, Respiratory Rate >20, WBC >12,000 or < 4,000**
- What is sepsis?
 - o **SIRS + bacteremia or suspected infection**
- What is shock?
 - o **Sepsis with inability to maintain BP with fluid resuscitation**
- What is severe shock?
 - o **Shock with evidence of end-organ damage**
- Where does our patient fit on this spectrum?
 - o **Shock—patient requiring pressors to maintain BP. Patient has known source of infection.**

Criteria cited from: Neviere R. Sepsis and the systemic inflammatory response syndrome: definitions, epidemiology, and prognosis. UPTODATE [Internet]. [modified 2012 October; cited 2012 Mar 21]. Available from: <http://www.uptodate.com>

The final slide concludes the patient's course with her discharge in stable and improving condition. The patient does spend time in the ICU. However, critical care obstetrics is beyond the point of this module. Focus should remain on septic shock as a complication of acute pyelonephritis and its diagnosis.

Feedback

Directions:

We suggest that you take time to collect feedback about the case. Feedback will enable you to fine tune this experience in the future. Collecting it now will eliminate the logistical difficulties of collecting feedback from students on busy rotation schedules. The authors have included their form that was used for collecting feedback. Feel free to modify the sample form to suit your own needs or use your own tools for collecting feedback. Below were our directions to our facilitators for collecting feedback. But again feel free to generate your own directions.

Students will split into two groups, each with one copy of the feedback form. The groups will collaboratively fill out the sheet, with specific instructions to leave written comments in the space provided.

Works Cited for the Guide

Duleba A, Mahutte N. Evaluating diagnostic tests. UpToDate [Internet]. 2012 Apr 5. [Cited 2013 June 2]. Available from: www.uptodate.com

Fekete T, Hooton T. Approach to the adult with asymptomatic bacteriuria. UpToDate [Internet]. 2012 Apr 5 [cited 2012 May 20]. Available from: <http://www.uptodate.com>

Kilpatrick C, Orejuela F. Approach to abdominal pain and the acute abdomen in pregnant and postpartum Women. UpToDate [Internet]. 2012 Feb 15 [cited 2012 Feb 20]. Available from: www.uptodate.com

Lockwood C, Magriples U. The initial prenatal assessment and routine prenatal care. UpToDate [Internet]. [modified 2012 Mar 6; cited 2012 Mar 20]. Available from: www.uptodate.com

Macejko A, Schaeffer A. Asymptomatic Bacteriuria and symptomatic urinary tract infections during pregnancy. *Urology Clinics of N. America*. 2007;34: 35–42.

Rogers V, Worley K. CURRENT Medical Diagnosis & Treatment 2012. Ed. McPhee S. Access Medicine [Internet]. 2012 [cited 2012 May]. Chapter 19: Obstetrics and obstetric disorders. Available from: <http://www.accessmedicine.com>

Neviere R. Sepsis and the systemic inflammatory response syndrome: definitions, epidemiology, and prognosis. UPTODATE [Internet]. [modified 2012 October; cited 2012 Mar 21]. Available from: <http://www.uptodate.com>

Schaeffer AJ. *Campbell's Urology*. 8th ed. Ed. Walsh PC, Retik AB, Vaughan ED Jr. Philadelphia: WB Saunders; c2002. Infections of the urinary tract. p. 516–602

Dashe JS, Gilstrap 3rd LC. Antibiotic use in Pregnancy. *Obstetrics and Gynecology Clinics of North America* 1997;24(3):617–29.

Sharp H. The acute abdomen during pregnancy. *Clinical Obstetrics and Gynecology*. 2002;45(2):405–413.

Stone K. Acute abdominal emergencies associated with pregnancy. *Clinical Obstetrics and Gynecology*. 2002;45(2):553–561.

Beery P, Ellison EC, Mikami D. *Sabiston Textbook of Surgery*. 19th ed. Ed Beauchamp RD, Evers BM, Mattox KL, Townsend C. MDConsult [Internet]. 2012 [cited 2012 June 2]. Chapter 72, Surgery in the Pregnant Patient. Available from: <http://www.accessmedicine.com>