MECHANISMS OF HUMAN DISEASE
AND
PHARMACOLOGY & THERAPEUTICS

CASE-BASED SMALL GROUP DISCUSSION

SESSION 3
MHD I
Bacteria

September 12, 2018

STUDENT COPY
CASE 1
Cc: chills, leg pain, and drainage from a wound developing <24 hours after a penetrating injury

A 28 year-old western Montana cattle rancher, living 25 miles from his nearest neighbor and 150 miles from the nearest clinic (See graphic below) and hospital, falls while repairing the roof on his barn and impales his left leg on a lightning rod. As he was used to doing with other injuries, he cleaned the wound with soap and water and some hydrogen peroxide, and then wrapped it with a towel held in place by an ace bandage. The following morning he had shaking chills and severe leg pain. His leg was swollen and warm, with cloudy fluid draining from a very darkened wound site. After multiple phone calls, he reached a friend who was able to drive him to the hospital in the later afternoon, where he was found to be stuporous, but able to answer questions.

Physical Exam: T= 36.5 °C, P=120, RR=24, BP=86/50. Examination of the left leg: tense edema to mid thigh, marked tenderness with blanching of skin and tense bullae (fluid collections) around the wound site. The skin also contained dark areas of apparent necrosis, with serosanguinous, dirty, foul smelling discharge from the wound. Palpation of skin revealed crepitus.

Gram stain of discharge revealed rare WBC’s and many Gram positive rods.
Learning Objectives

1. Given the clinical scenario, what organism is most likely represented on the Gram stain?

   (complete the map)
2. What is your clinical diagnosis? Summarize the pathogenesis of the infection in this patient. Be sure to comment on the role of toxins produced by this organism.

3. Correlate the clinical findings and Gram stain findings with the pathogenesis.

4. How is this disease diagnosed most rapidly?

The patient is determined to require emergent surgical debridement of the wound. The general surgeon on call is finishing up a case and takes him to the operating room in 60 minutes.

5. What is the role of surgical debridement for this disease process?
Pharmacology-Therapeutics Correlation

6. The patient has a Penicillin allergy; he states his “throat swelled” from it. What antibiotic therapy would you recommend? What is the antibiotic’s mechanisms of action? Name a classic adverse effect.

7. The healthcare providers treating the patient upon presentation to the hospital should determine his immunization status for which specific bacteria. Why?

8. Review the Case Images:

   Bacteriology – Set 12

After a 10-day hospital stay, the patient is discharged to home. His discharge instructions include follow-up with his surgeon in 1 week. Because of his right leg injury and surgeries, he was instructed to not drive until further evaluation. The surgeon’s office is 2 ½ hours away from the patient’s home. While he was able to keep his first follow-up appointment, multiple “logistic issues” resulted in the patient’s missing his next 2 appointments.

Patient outcomes depend on multiple factors which include
- Disease severity or physiologic differences
- Physician management
- Patient adherence (cost, health literacy)
- Health System factors
- Other environmental factors
9. Which of these factors played the largest role in the patient’s outcome for this case? Discuss potential solutions. Include opportunities for changes in physician management.
Case 2
CC: Left lower quadrant pain for 24 hours

A 57-year-old man presented with left lower quadrant abdominal pain. The pain began about 24 hours prior to admission and steadily worsened. Eventually any movement seemed to exacerbate the pain. He was going to “tough it out” at home, but the development of fever to 101 degrees Farenheit prompted him to seek medical attention. He had nausea the day of admission and a decreased appetite. His last bowel movement was 2 days prior and was normal in color, though more loose than usual. He never had pain like this before.

He has a history of hypertension well-controlled on hydrochlorothiazide 25mg daily.

He has had no surgeries.

He has never smoked and rarely drinks alcohol.

He reports having a penicillin allergy – he does not know the associated reaction he experienced in childhood

Physical exam revealed the following:
Temperature 99.9 F, pulse 102, BP 101/68, respirations 20.
ENT, heart, and lung exams were normal.
On abdominal exam there was left lower quadrant tenderness to palpation with involuntary guarding.
There was a mass with overlying warmth in the same region.

Educational Objectives:

1. Develop a problem list.

The physician formulates a differential diagnosis with pertinent positives and negatives for each of the possible diagnoses.
Diagnostic studies are ordered.

Electrolytes are normal.
Urinalysis is normal.
CBC shows a normal hgb and platelet count and leukocytosis (WBC 17,000 with bandemia)

CT ABDOMEN AND PELVIS
COMPARISON: NONE
TECHNIQUE* 5MM THICK IMAGES WERE TAKEN THROUGH THE ABDOMEN AND PELVIS FOLLOWING THE ADMINISTRATION OF NONIONIC AND INTRAVENOUS ORAL CONTRAST MATERIAL.

FINDINGS:
ABDOMEN: THERE IS A PUNCTATE LOW ATTENUATION STRUCTURE IN THE POSTERIOR ASPECT OF THE RIGHT HEPATIC LOBE TOO SMALL TO CHARACTERIZE BY CT. THERE IS NO BILIARY DUCTAL DILATATION. THERE ARE CALCIFIED CALCULI WITHIN THE GALLBLADDER LUMEN, WITH MILD AND IRREGULAR THICKENING OF THE GALLBLADDER WALL, NONSPECIFIC FOR CHOLECYSTITIS.
THE SPLEEN IS NORMAL IN SIZE. THE PANCREAS DEMONSTRATES GROSSLY HOMOGENEOUS ENHANCEMENT AND REGULAR CONTOURS, WITHOUT INTRA OR EXTRAHEPATIC FLUID COLLECTIONS OR GROSS INFRINGEMENT OF THE PERIPANCREATIC FAT. THERE ARE NO PANCREATIC CALCIFICATIONS.

THERE IS NO ADRENAL MASS. THERE IS A 6MM NONSPECIFIC LOW ATTENUATION STRUCTURE IN THE LEFT KIDNEY. THERE ARE NO CALCULI OF HYDRONEPHROSIS.

PELVIS:

THERE IS EXTENSIVE SIGMOID COLONIC DIVERTICULOSIS. THERE IS FOCAL COLON WALL THICKENING WITH PERICOLOCNIC STRANDING AND AN ADJACENT COLLECTION OF FLUID AND GAS MEASURING 5 x 4 CM CONSISTENT WITH ABSCESS FORMATION. THERE IS NO EVIDENCE OF FREE AIR.

2. What is the likely diagnosis?

The pericolonic fluid collection is drained percutaneously under CT guidance. Approximately 60 cc of purulent material is initially obtained and a drainage catheter is left in place. The purulent material is submitted for aerobic and anaerobic culture.

Specimen: Abdominal Abscess

Gram stain:
- Many WBCs
- Many Gram negative rods
- Many Gram positive cocci in pairs and chains

3. What micro-organisms do you think might be involved in this infection? Do the results of the Gram stain fit the clinical scenario?

Pharmacology-Therapeutics Correlation

4. The medical team is debating their choice of empiric antibiotic therapy.
   a) Define what is mean by “empiric”.
   b) The team chooses a fluoroquinolone and metronidazole. Is this therapy rational? Why or why not?
   c) If this patient were a 22-year old pregnant woman with the same disease process, would you agree with the choice of antibiotics? Why or why not?
5. One of the Gram negative rods isolated from the fluid collection appears as faintly staining and pleomorphic. It is growing under anaerobic conditions and demonstrates resistance to kanamycin and vancomycin.
What is the most likely organism to be isolated? Discuss the virulence factor of this organism.

6. Gram negative rods, which are lactose fermenters, are growing under aerobic conditions. What is the most likely organism?
Case 3:
CC: “I have had a lump in my jaw on and off for the past month”

A 55 year-old man presents with a mass of his left submandibular area. The patient initially had swelling in this area which was treated with amoxicillin/clavulanate for one week. The swelling resolved, but recurred one month later. In addition, the patient has had an intermittent toothache in his left lower molars for the last 5 days.

He drinks a 6 pack of beer daily. He has a heroin use disorder use but has abstained since his last drug detoxification program 4 months ago and is in enrolled in a methadone maintenance program. He smokes 1 ½ packs of cigarettes per day and has done so for the past 35 years.

PE: Temp: 99.8°
Patient is in no acute distress. Clothes strongly smell of cigarette smoke
Skin: 3 cm x 4 cm red-bronze area of swelling at angle of the jaw on left, woody induration, nontender. There appears to be a draining sinus tract.
Mouth: multiple carious teeth, multiple foci of gingival redness and swelling, left lower molar with surrounding erythema, fluctuant, tender swelling of the gingiva

Educational Objectives

1. What is the main clinical problem? Develop a differential diagnosis.

Fine needle aspirate of the submandibular mass is done and sent for culture and cytology. Gram stain of the aspirate revealed branching Gram-positive filamentous organisms.

2. What 2 organisms could be represented by the Gram stain?

The organism stains negative on Modified Acid Fast stain

3. What is the organism most likely causing this infection? How should this specimen be cultured?
4. What were the risk factors for acquiring the infection in this patient?

5. What treatment would you recommend?

6. Review the Case Images:

   **Bacteriology – Set 7**
CASE 4:
CC: Pain and swelling of right thigh x 2 weeks

A 60 year-old man who is 4 months post-orthotopic heart transplant for ischemic cardiomyopathy presents with a 2 week history of increasing pain, swelling and tenderness in his right thigh. The pain is ~6/10 at rest and increases to 8/10 with activity. The patient also has had a fever to 101° F over the last 2 days.
Medications include: Cyclosporine, prednisone and azathioprine.

PE: T. 38.0°C, BP 140/80, R-14, HR 80, No acute distress.
Lungs: Clear
Heart: S₁ and S₂ Normal, no S₃ S₄
Abdomen: soft, non-tender, no organomegaly.
Extremities: Right thigh with swollen, red, tender fluctuant 3cm x 3cm mass with some surrounding erythema and increased warmth.
Neuro: Within normal limits

LABORATORY DATA

Heme Final T2309

**CBC w/ DIFF**

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CHEST, PA \LAT

HISTORY: FEVER IN HEART TRANSPLANT PATIENT

THE PATIENT IS STATUS POST PREVIOUS HEART TRANSPLANT. THE CARDIAC SILHOUETTE REMAINS MILDLY ENLARGED WITHOUT CHANGE. THE MEDIASTINAL CONTOURS ARE NORMAL. THE PULMONARY VASCULATURE IS NORMAL.
THERE ARE THREE NODULES IN THE RIGHT UPPER LUNG, THE LARGEST MEASURING 2CM. THESE ARE NEW SINCE THE PREVIOUS CHEST RADIOGRAPH.

Aspirate of the right leg mass is done and shows acute inflammation and Gram-positive irregularly stained or beaded, branching filamentous organisms. The organisms stain positive on modified acid fast stain.

Eduational Objectives
1. What is the organism causing this patient’s soft tissue infection?

2. What is the most likely etiology of the lung nodule? How would you confirm this?

3. What are the patient's risk factors for this infection?

4. What is the appropriate antibiotic therapy?

5. Review the Case Images:

Bacteriology – Set 8

Faculty will provide you with a table to complete during or after the small group session
Case 5 – Data will be provided during the small group session