Author: Sarah Farris, M.D. Reviewer: Lisa Jacobson, M.D.

Case Title: Hepatic Encephalopathy

# Target Audience: Emergency Medicine residents, medical students

Primary Learning Objectives: key learning objectives of the scenario

1. Recognize the physical characteristics of liver failure

2. Construct a thorough differential diagnosis for fever and altered mental status in a patient with liver failure

3. Identify and manage hepatic encephalopathy

4. Identify and manage spontaneous bacterial peritonitis

Secondary Learning Objectives:

1. Demonstrate how to perform a paracentesis.

2. Review diagnosis and treatment for spontaneous bacterial peritonitis.

3. Review diagnosis and treatment for hepatic encephalopathy.

Critical Actions Checklist

1. Recognize hepatic encephalopathy
2. Order LFTs, ammonia, coags
3. Consider causes of HE
4. Give lactulose/rifaximin
5. Obtain consent for paracentesis
6. Interpret ascetic fluid correctly
7. Treat for SBP
8. Admit to general medicine

## Environment (if using as a simulation case)

1. Room Set Up – ED, trauma bay, or simulation lab
   1. Manikin Set Up – high-fidelity simulator, peripheral IVs, sodium chloride IV solution, antibiotics
   2. Props – paracentesis kit +/- model (if available), airway equipment, code blue cart
2. Distractors – None

## Actors (optional)

1. Roles – ED resident, airway resident or respiratory therapist, nurse, paramedics
2. Who may play them – any of the above

**For Examiner Only**

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Case Title: Hepatic Encephalopathy

**CASE SUMMARY**

**CORE CONTENT AREA**

Hepatology, Neurology

**SYNOPSIS OF HISTORY/ Scenario Background**

Ms. Butters is a 53 year old female brought to your Emergency Department by ambulance after a neighbor saw the patient “staggering around” outside. The patient’s medical history is currently not available. The paramedics tell you that when they arrived, Ms. Butters was lying on the ground asleep and woke to light touch. They also note that Ms. Butters has been mumbling something about a dog and knows her own name, but is not oriented to place, time, or situation. The patient’s sister will call the ED in 5-10 minutes and has no useful history other than to say that she has not seen the patient in several years due to the patient’s heavy alcohol abuse.

Chief Complaint: altered mental status, found down

Past medical history: Unknown

Medications and allergies: Unknown

Family and social history: Unknown, but pt thinks she might smoke cigarettes

**SYNOPSIS OF PHYSICAL**

VS: HR 123 BP 95/40 RR 18 Pulse ox: 95% on RA (T=38.5 R or 38 orally, only reveal if asked for)

Primary exam:

Airway: intact

Breathing: tachypneic

Circulation: tachycardic with regular pulses, skin warm to the touch

Secondary Exam:

Gen: Thin female with muscle wasting, sleepy, wakes to voice and mumbles incoherently

HEENT: faint scleral icterus, normocephalic, atraumatic

Neck: normal

Lungs: CTAB, mild tachypnea

Cardiac: tachycardic, rhythm regular, no M/R/G

Abdomen: abd distended, soft, mild diffuse tenderness, + BS

Extremities: muscle wasting, no evidence of trauma

Neurologic: GCS 13 (E3/V4/M6), moves all four extremities, speech mildly slurred, sleepy but wakes to voice

**For Examiner Only**

**CRITICAL ACTIONS**

**Scenario branch points/ PLAY OF CASE GUIDELINES**

1. **Check a Fingerstick glucose and temperature.**

The BS is normal but needs to be evaluated by the learner. Patient is febrile, but learner will need to ask examiner to provide this information

Cueing Guideline: If no temperature obtained after several minutes, nurse will say, “Doctor, Ms. Butters feels very warm.”

1. **Perform a diagnostic paracentesis.**

If level appropriate and time permitting, can ask learner to describe the steps of paracentesis or perform them on a model.

1. Obtain informed consent (from family, available by phone)
2. Explain procedure to patient, who is somewhat altered
3. Gather supplies (paracentesis kit, sterile gloves)
4. Ultrasound to evaluate depth, make sure bowel is not adhered to peritoneum
5. Sterile precautions including gown/mask/gloves, iodine or chlorhexadine on abdomen followed by sterile draping
6. Set up kit including preparing tubes
7. Lidocaine in Z-track for anesthesia
8. Nick skin with scalpel
9. Insert paracentesis catheter, obtain fluid
10. Withdraw catheter, place sterile bandage over site
11. Discard sharps safely
12. **Recognize Spontaneous Bacterial Peritonitis and treat with appropriate antibiotics.**

The following regimens (or close to them) are acceptable:

1. Cefotaxime 2 grams IV q8hour
2. Gentamicin 1 mg/kg IV q8 hour + Ampicillin 3 grams IV q6 hour

Cueing Guideline: Patient will worsen (hypotension, tachycardia, fever) without antibiotic treatment. If diagnosis is still not discovered, patient complains of abdominal pain with slurred speech. If still SBP is not recognized and treated, nurse can say, “Doctor, Ms. Butters’s abdomen is very distended and painful.”

1. **Order LFTs, coags, and ammonia.**

Labs should include liver function tests, coags, and ammonia.

Cueing Guideline: Give 1-2 lines on how to prompt the candidate if he/she is having problem.

1. **Recognize hepatic encephalopathy and treat with appropriate medications**

Medication options include:

Lactulose 30 mL po x1, may repeat once per 24 hours

Rifaximin 550 mg po q12hour

Cueing Guideline: Patient’s mental status will continue to decrease without treatment. May describe asterixis to learner if indicated. If learner does not recognize this after 5-10 minutes, may state that a family member has arrived and gives PMHx as HTN, chronic liver failure, and alcoholism.

**SCORING GUIDELINES**

(Critical Action No.)

1. Check a temperature: may prompt inexperienced learner
2. Perform a simulated paracentesis or describe correct steps: alter by level of learner
3. Diagnose and treat spontaneous bacterial peritonitis: ascertain whether learner knows SBP criteria in analysis of ascites fluid
4. Order appropriate hepatic labs (LFTs, coags, ammonia) and correctly diagnose hepatic encephalopathy
5. Treat hepatic encephalopathy appropriately
6. Depending on the level of the learner, this case may be scored at the highest level if learner provides the correct antibiotics, lactulose therapy and rifaximin.

**For Examiner Only**

**HISTORY**

**Onset of Symptoms:** The patient was seen “staggering around” outside by a neighbor one hour prior to arrival in the Emergency Department.

**Background Info:** Ms. Butters is a 53 year old female unable to give any history. Later, her sister calls the Emergency Department and can give some history

**Chief Complaint:** Per EMS, found down with altered mental status. Patient is sleepy and has no complaints.

**Past Medical Hx:** Initially unknown, later a family member is available by phone who

gives a PMHx of HTN, liver disease, and alcohol

**Past Surgical Hx:** None.

**Habits:** Smoking: patient states “maybe,” later denied by patient’s sister

ETOH: unknown, later confirmed by patient’s sister via phone

Drugs: unknown, later denied by patient’s sister via phone

**Family Medical Hx:** Initially unknown, Mother with diabetes later given by patient’s sister via phone

**Social Hx:** Marital Status: unknown, sister later states single

Children: unknown, sister later states none

Education: unknown, sister later states some college

Employment: unknown, sister later states patient works at movie theater

**ROS:**  Patient does not give ROS due to altered mental status

**For Examiner Only**

**PHYSICAL EXAM**

**Patient Name:** Edna Butters **Age & Sex:** 53 year old female

**General Appearance:** Thin female with muscle wasting, sleepy, wakes to voice and mumbles incoherently

**Vital Signs:** HR 123 BP 95/40 RR 18 Pulse ox: 95% on RA

(Temp=38.5 R or 38 orally, only available if specifically asked for)

**Head:** Atraumatic

**Eyes:** PERRL (5 mm 🡪 3 mm bilaterally), moderate scleral icterus noted

**Ears:** Canals clear, TM normal bilaterally

**Mouth:** Multiple dental caries, no oral lesions, airway patent

**Neck:** Normal, non-tender

**Skin:** Dry, no rashes or erythema noted

**Chest:** No deformities, non-tender to palpation

**Lungs:** Mildly tachypneic, lungs clear to auscultation bilaterally, no retractions

**Heart:** Tachycardic with regular rhythm; no murmurs, rubs, or gallops

**Back:** Normal

**Abdomen:** Distended, diffuse mild tenderness, no rebound or guarding

**Extremities:** Diffuse muscle wasting, no evidence of trauma, 1+ distal pulses throughout

**Rectal:** Non-tender, brown stool is trace guiac positive. External hemorrhoid.

**Pelvic:** Likely deferred. If performed, exam is normal.

**Neurological:** Unable to assess orientation due to unintelligible mumbling in response to questions. Moves all four extremities. CN II-XII grossly intact. 3+ reflexes throughout.

**Mental Status:** Decreased, wakes briefly to voice and opens briefly opens eyes. Does not answer any questions intelligibly.

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**STIMULUS INVENTORY**

#1 Emergency Admitting Form

#2 CBC

#3 BMP

#4 U/A

#5 Liver Function Tests and Ammonia

#6 Ascites analysis

#7 Toxicology

#8 CXR

#9 CT

#10 PT/PTT/INR

#11 Debriefing materials

**For Examiner Only**

**LAB DATA & IMAGING RESULTS**

**Stimulus #2 Stimulus #5**

**Complete Blood Count (CBC) Liver function tests**

WBC 13.5/mm3 AST 532 IU/L Bili total 4.8 mg/dL

Hgb 10.2 g/dL ALT 645 IU/L Bili direct 0.8 mg/dL

Hct 31% Albumin 3.7 g/dL Alk Phos 125 IU/mL

Platelets 95/mm3 Ammonia 147 mg/dL

Differential

Segs 90% **Stimulus #6**

Bands 1% **Paracentesis Fluid**

Lymphs 7% PMNs 435 /µL

Monos 2% Albumin 2.7 g/dL

Eos 0% Gram stain Gram negative rods

**Stimulus #3 Stimulus #7**

**Basic Metabolic Profile (BMP) Toxicology**

Na+ 131 mEq/L Serum

K+ 3.8 mEq/L Salicylate Neg

CO2 28 mEq/L Acetaminophen Neg

Cl- 98 mEq/L Tricyclics Neg

Glucose 92 mg/dL ETOH 105 mg/dl

BUN 36 mg/dL Urine

Creatinine 1.7 mg/dL Cocaine Neg

Cannabinoids POS PCP Neg

**Stimulus #4** Amphetamines Neg

**Urinalysis (U/A)** Opiates Neg

Color yellow Barbiturates Neg

Sp gravity 1.010 Benzodiazepines Neg

Glucose neg

Protein neg **Verbal Reports**

Ketone neg pulse ox 98% on RA

Leuk. Est. neg pulse ox stable throughout case

Nitrite neg

WBC 0-1 **Diagnostic Imaging**

RBC 0-1

**Stimulus #8**

CXR: Negative

**Stimulus #9**

Head CT: Negative

**Stimulus #10**

**Coagulation labs**

PT 17 sec

PTT 53 sec

INR 1.7

**Learner Stimulus #1**

**ABEM General Hospital**

**Emergency Admitting Form**

Name: Edna Butters

Age: 53 years

Sex: Female

Method of Transportation: EMS

Person giving information: Paramedic

Presenting complaint: Staggering, found down on front lawn

**Background:** The patient was seen “staggering around” outside by a neighbor one hour prior to arrival in the Emergency Department. She wakes up and mumbles but cannot give any further history personally. The social worker is trying to get ahold of the patient’s sister, but there is currently no further information available.

**Initial Vital Signs**

BP: 95/40

P: 123

R: 18

Oxygenation: 95% on RA

**Learner Stimulus #2**

**Complete Blood Count (CBC)**

WBC 13.5/mm3

Hgb 10.2 g/dL

Hct 31%

Platelets 95/mm3

Differential

Segs 90%

Bands 1%

Lymphs 7%

Monos 2%

Eos 0%

**Learner Stimulus #3**

**Basic Metabolic Profile (BMP)**

Na+ 131 mEq/L

K+ 3.8 mEq/L

CO2 28 mEq/L

Cl- 98 mEq/L

Glucose 92 mg/dL

BUN 36 mg/dL

Creatinine 1.7 mg/dL

**Learner Stimulus #4**

**Urinalysis (U/A)**

Color yellow

Sp gravity 1.010

Glucose neg

Protein neg

Ketone neg

Leuk. Est. neg

Nitrite neg

WBC 0-1

RBC 0-1

**Learner Stimulus #5**

**Liver function tests**

AST 532 IU/L

ALT 645 IU/L

Bili total 4.8 mg/dL

Bili direct 0.8 mg/dL

Albumin 3.7 g/dL

Alk Phos 125 IU/mL

Ammonia 147 mg/dL

**Learner Stimulus #6**

**Paracentesis Fluid**

PMNs 435 /µL

Albumin 2.7 g/dL

Gram stain Gram negative rods

**Learner Stimulus #7**

**Toxicology**

Serum

Salicylate Neg

Acetaminophen Neg

Tricyclics Neg

ETOH 105 mg/dl

Urine

Cocaine Neg

Cannabinoids POS

PCP Neg

Amphetamines Neg

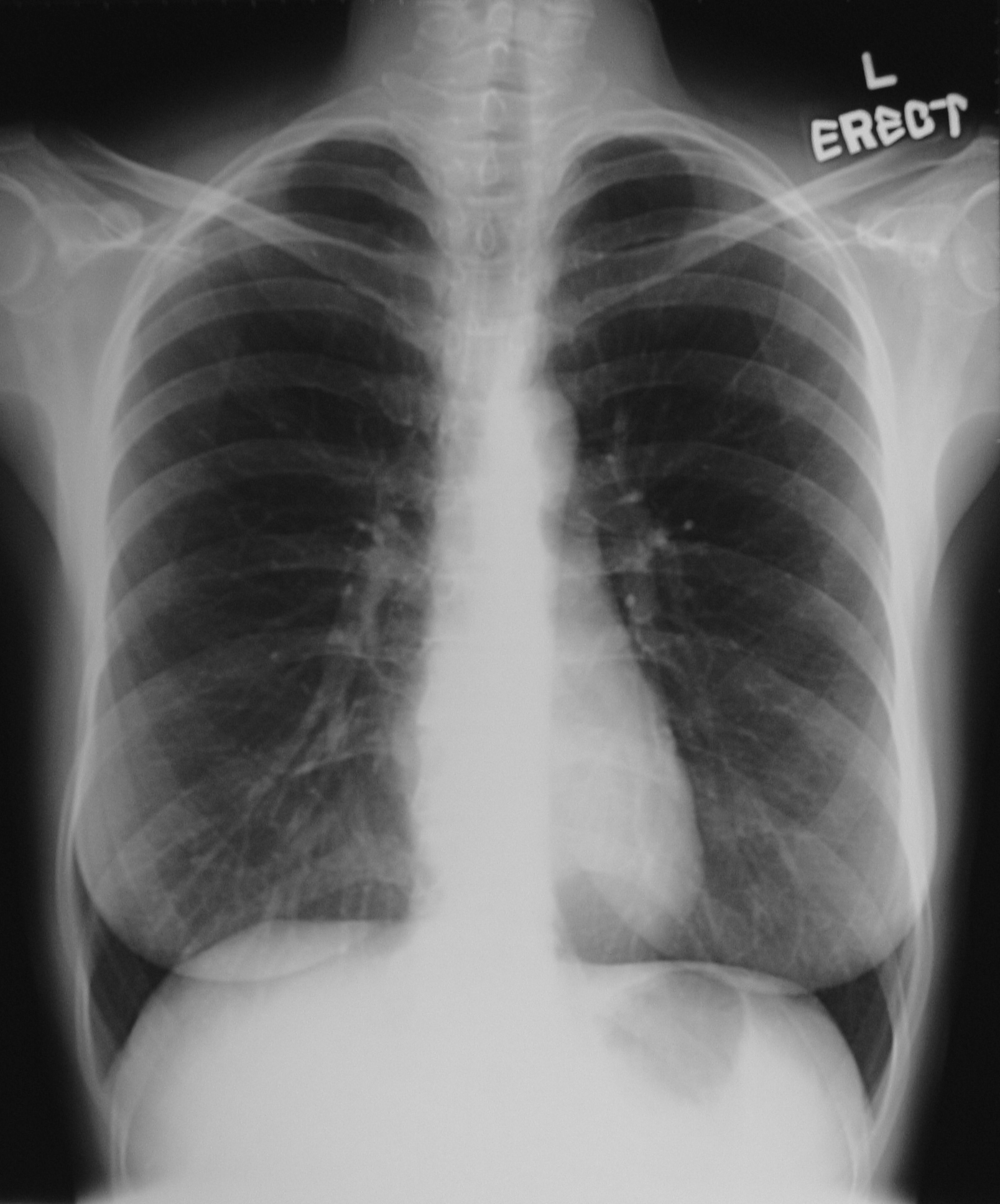
Opiates Neg

Barbiturates Neg

Benzodiazepines Neg

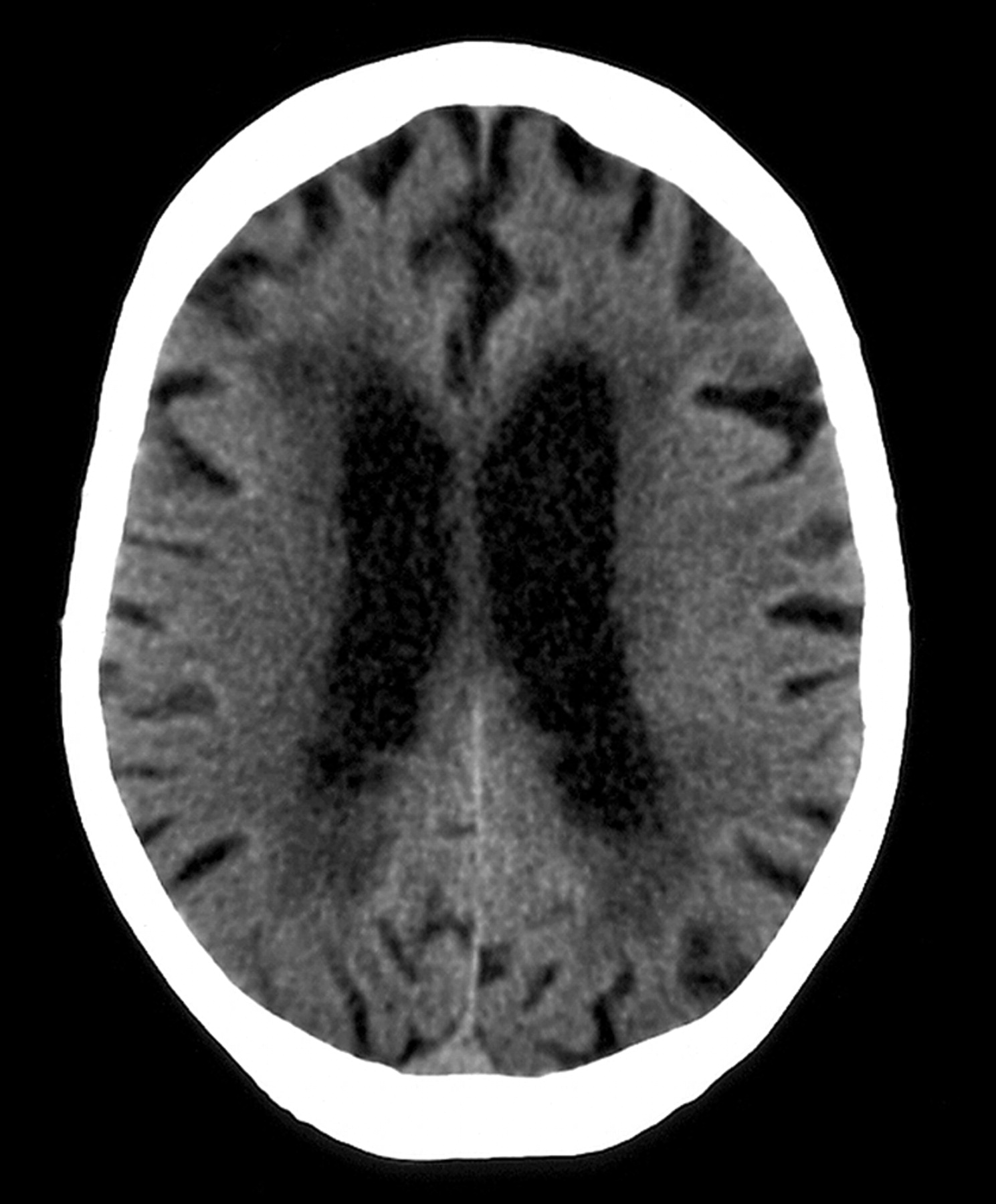
**Learner Stimulus #8**

CXR



**Learner Stimulus #9**

Head CT



**Stimulus #10**

**Coagulation labs**

PT 17 sec

PTT 53 sec

INR 1.7

**For Examiner**

Date: Examiner: Examinee(s):

Scoring: In accordance with the Standardized Direct Observational Tool (SDOT)

The learner should be scored (based on level of training) for each item above with one of the following:

NI = Needs Improvement

ME = Meets Expectations

AE = Above Expectations

NA= Not Assessed

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Critical Actions** | **NI** | **ME** | **AE** | **NA** | **Category** |
| Recognize hepatic encephalopathy |  |  |  |  | PC, MK |
| Order LFTs, ammonia, coags |  |  |  |  | PC, MK |
| Consider causes of HE |  |  |  |  | PC, MK |
| Give lactulose/rifaximin |  |  |  |  | PC, MK, PBL |
| Obtain consent for paracentesis |  |  |  |  | PC, MK, PBL |
| Perform paracentesis |  |  |  |  | PC, MK, PBL |
| Interpret ascetic fluid correctly |  |  |  |  | PC, MK, PBL |
| Treat for SBP |  |  |  |  | PC, MK, PBL |
| Admit to general medicine |  |  |  |  | PC, MK, SBP |

The score sheet may be used for a variety of learners. For example, in using the case for 4th year medical students, the key teaching points of the case may be the recognition of shock and treatment with appropriate fluid resuscitation. Other items may be marked N/A= not assessed.

Category: One or more of the ACGME Core Competencies as defined in the SDOT

PC= Patient Care

Compassionate, appropriate, and effective for the treatment of health problems and the promotion of health

MK= Medical Knowledge

Residents are expected to formulate an appropriate differential diagnosis with special attention to life-threatening conditions, demonstrate the ability to utilize available medical resources effectively, and apply this knowledge to clinical decision making

PBL= Practice Based Learning & Improvement

Involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care

ICS= Interpersonal Communication Skills

Results in effective information exchange and teaming with patients, their families, and other health professionals

P= Professionalism

Manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population

SBP= Systems Based Practice

Manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value

**Debriefing Materials:**

**Optional material available for review after scenario completion.**

**Medications for SBP**

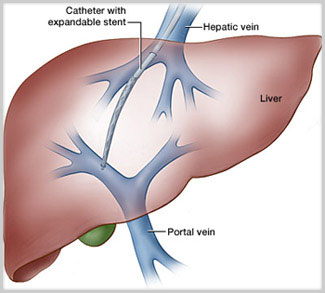
* 1. Cefotaxime 2 grams IV q8hours
  2. Gentamicin 1 mg/kg IV q8hour + ampicillin 3 grams IV q6hour
  3. Pipercillin/tazobactam 4.5 grams IV
  4. If penicillin allergic, consider Ciprofloxacin 400 mg + Vancomycin 1 gram IV

**Medications for hepatic encephalopathy**

* + Lactulose 30 mL po x1, may repeat once per 24 hours
  + Rifaximin 550 mg po q12hour

**Causes of hepatic encephalopathy**

* Infection
* GIB
* Electrolyte abnormalities, especially hyponatremia
* Hypoxia
* Renal failure
* Dehydration
* Hepatic shunt malfunction



**Diagram of TIPS**

**Review indications and steps of paracentesis, interpretation of fluid**

**Indications:**

Typically indicated in any patient with abdominal tenderness and ascites, particularly if fever, leukocytosis, or altered mental status present. Be cautious in patients with thrombocytopenia or hypocoagulability.

**Steps:**

1. Obtain informed consent
2. Explain procedure to patient, who is somewhat altered
3. Gather supplies (paracentesis kit, sterile gloves)
4. Ultrasound to evaluate depth, make sure bowel is not adhered to peritoneum
5. Sterile precautions including gown/mask/gloves, iodine or chlorhexadine on abdomen followed by sterile draping
6. Set up kit including preparing tubes
7. Lidocaine in Z-track for anesthesia
8. Nick skin with scalpel
9. Insert paracentesis catheter, obtain fluid
10. Withdraw catheter, place sterile bandage over site
11. Discard sharps safely

**Interpretation of paracentesis fluid**

* Peritoneal fluid polymorphonuclear neutrophil (PMN) count greater than 500 cells/µL: These patients universally should be admitted and treated for spontaneous bacterial peritonitis regardless of peritoneal fluid Gram stain result. Empiric therapy as discussed below should be initiated unless microbiologic studies further guide treatment.
* Peritoneal fluid PMN count of 250-500 cells/µL: All symptomatic patients in this group should be admitted and treated for spontaneous bacterial peritonitis.
* Peritoneal fluid PMN count less than 250 cells/µL: Management of this group depends upon the results of ascitic fluid cultures. All symptomatic patients should be admitted. Patients whose culture results are positive should be treated for spontaneous bacterial peritonitis. A select subset of patients who are completely asymptomatic yet have positive culture results may be managed without treatment but must undergo a follow-up paracentesis within 24-48 hours.

**Review physical exam findings in liver failure**

* Muscle wasting
* Dry skin
* Jaundice and scleral icterus
* Distended abdomen
* Ascites
* Hemorrhoids
* Varicose veins in abdominal wall
* Asterixis (hand flapping)
* Fetor hepaticus (severely bad breath)

**Keywords:**

Hepatic encephalopathy, liver failure, spontaneous bacterial peritonitis, altered mental status

**References**

Thompson TW, et al. Paracentesis. NEJM 2006;355:e21.

Video can be seen at:

http://www.youtube.com/watch?v=\_s-dRKq0O4&p=356285A3309978F7&playnext=1&index=27

American College of Gastroenterology lecture notes on Chronic Liver Disease 2009

http://www.acg.gi.org/acgmeetings/pdfs/09pgcourse/ACG2009PG1052.PDF

**Has this work been previously published?**

No.