

### Healthcare Team Case

You and your highly esteemed colleagues have been assembled into a healthcare team to help assess the condition of one of our patients. You are responsible for diagnosing the patient's condition so our providers can take appropriate next steps for effective treatment. You have been given a budget of \$300 to perform the appropriate tasks and tests required to obtain the information you need. You will be evaluated as you work through the case to ensure the approach you take is sound and your conclusions are accurate.

#### **You are responsible for the following:**

1. Strategize with your team to develop the plan you will follow to diagnose the patient.
2. Operate within the given budget (\$300) for this case.
3. Gather the necessary evidence to determine the patient's condition.
4. Collaborate within your team effectively.
5. Submit your final diagnosis and conclusion to the attending provider.

#### **Directions to follow for each requirement:**

1. Spend 10 minutes determining how you plan to work through this case. Consider the restrictions you may encounter with your given budget and how to efficiently obtain the information you need. Write an outline of your plan to submit to the attending provider for review before you see the patient. It may be beneficial to consider how to keep your plan flexible to adjust to any unexpected results.
2. Keep track of your budget so you know which tasks and tests you are still able to perform.
3. Submit a task or test to the attending provider to obtain results. You must wait *at least 5 minutes* between each ordered test. Each time you submit a task or test, you must explain to the attending provider the reasoning for your choice. You may use any information from the course, your notes, your journal, or online to help guide your reasoning. Your team can use the provided laptops to assist with your efforts.
4. Each time your team submits a task or test to be performed you are required to talk with the attending provider to provide your reasoning. A different member of your team must provide this explanation each time, so make sure everyone on your team is on the same page.
5. Using the provided report form, write up your final diagnosis and conclusions to submit to the provider. Be sure you include the specific evidence that led you to your conclusion and a brief explanation of how each piece of evidence supports your diagnosis.

**Your case:** A 46-year-old woman was been admitted with shortness of breath, lethargy, and dry cough that has lasted for 4 days. The patient is dyspneic, disoriented, and has difficulty talking. Patient arrived from a long-term care facility.

Available Tasks and Tests with Pricing

rRNA gene sequencing – \$50

Angiography – \$80

Antigen/antibody Test (must specify the antigen/antibody tested for) – \$20

Barium swallow x-ray – \$100

Basic Metabolic Panel – \$30

Biopsy (must specify tissue) – \$40

Blood/fluid culture – \$40

Chest x-ray – \$50

Complete blood cell count – \$40

Computed tomography (CT) (must specify body part) – \$100

Endoscopy – \$70

Family medical history – \$20

Lactic Acid Blood Test - \$20

Lipid panel – \$30

Patient interview – \$10

Physical assessment – \$20

Pulmonary function tests – \$30

Selective and differential media plating (must specify the media used) – \$20

Skin allergy tests – \$40

Social history – \$20

Urine culture – \$40

Whole-genome sequencing – \$150

18S rRNA gene sequencing

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

DNA purification from isolated microbe: positive

Concentration of DNA submitted for sequencing: 110 ng/ $\mu$ l

Primer: 515F

18S rRNA gene sequence:

```
tccgtagtg aacctgcgga aggatcatta ttgatatttt gcatacacac tgatttgat
tttaaaacta acccaacgtt aagtcaact aaaacaaaa cataaaactt tcaacaacgg
atctcttggg tctcgcacg atgaagaacg cagcgaaatg cgatacgtag tatgacttgc
agacgtgaat catcgaatct ttgaacgcac attgcgctt ggggtattcc ccaaggcatg
cctgtttgag cgtgatgtct ttcaccaat cttcgcggtg gcgttgcatc cacaaaatta
cagcttgcac gaaaaaatc tacgctttt tttcgtttt gttgtcgct caaatcaggt
aggactacc cgtgaactta agcatatcaa taagcggagg aaaaga
```

Sequence alignment for species identification can be performed using **Nucleotide BLAST**

<https://blast.ncbi.nlm.nih.gov/Blast.cgi>

Angiography

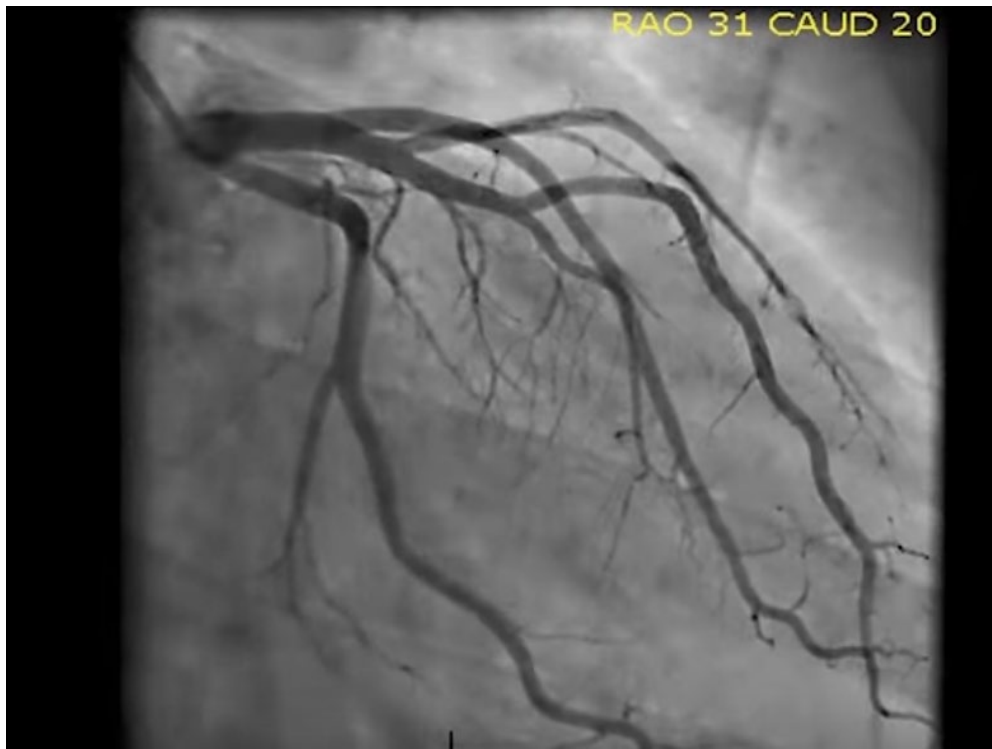
Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Report: No obstructions or abnormalities observed.

Full results of procedure available here: <https://youtu.be/HKXTZUYTxA>



Antigen/Antibody Test Results

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Antigen/Antibody: Human immunodeficiency viruses

Result: Negative

Antigen/Antibody Test Results

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Antigen/Antibody: SARS-CoV-2

Result: Positive

Antigen/Antibody Test Results

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Antigen/Antibody: \_\_\_\_\_

Result: No antigen or antibodies that correspond to the pathogen above were detected.

Barium swallow x-ray

Patient: Jane Doe

Date: 12/5/23

Sex: F Age: 46

Report: No signs of gastro-esophageal reflux disease. No signs of peptic ulcer disease. No esophageal perforation observed. No obstruction observed.



Basic Metabolic Panel

Patient: Jane Doe

Date Drawn: 12/5/23

Date Received: 12/5/23

Sex: F Age: 46

<u>Test</u>	<u>Result</u>	<u>Normal Range</u>
Glucose	97 mg/dL	70-100 mg/dL
Calcium	9.1 mg/dL	8.5-10.5 mg/dL
Sodium	135 mmol/L	135-145 mmol/dL
Potassium	3.6 mmol/L	3.4-5.0 mmol/L
Carbon dioxide	20 mmol/L	20-32 mmol/L
Chloride	99 mmol/L	95-108 mmol/L
Blood urea nitrogen	31 mg/dL	8-25 mg/dL
Creatinine	2.5 mg/dL	0.6-1.1 mg/dL

Biopsy results

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Tissue: Lymph node

Gross description: Received in bottle marked with patient's name is a 0.3 x 0.3 x 0.2 cm ellipse of tissue.

Microscopic description: Histological examination reveals normal lymphatic tissue.

Biopsy results

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Tissue: Skin

Gross description: Received in bottle marked with patient's name is a 0.3 x 0.3 x 0.2 cm ellipse of tissue.

Microscopic description: Histological examination reveals the dermal tissue does not appear abnormal on routine staining.

Biopsy results

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Tissue: \_\_\_\_\_

Gross description: Received in bottle marked with patient's name is a 0.3 x 0.3 x 0.2 cm ellipse of tissue.

Microscopic description: Histological examination reveals the tissue appears normal on routine staining.

Culture

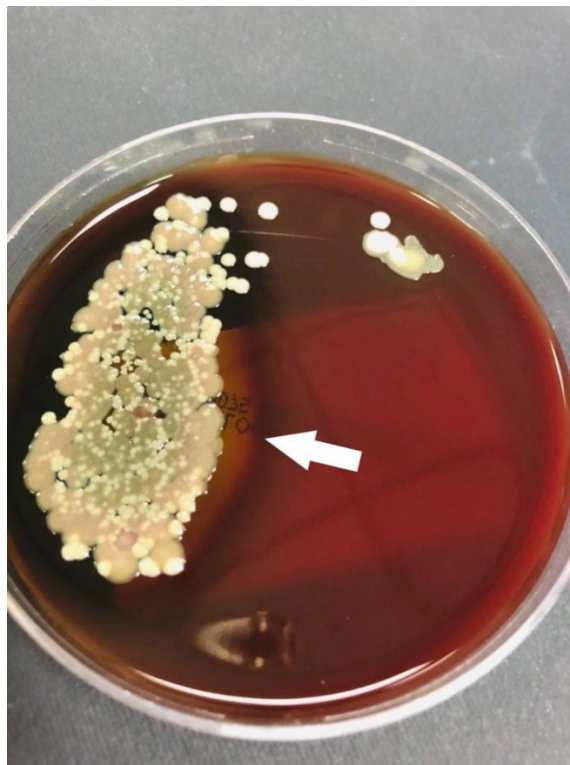
Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Sample: Blood

Report: Blood was diluted in PBS to appropriate concentration. 0.1 ml of diluted sample was plated on tryptic soy agar, blood agar, and Saboraud dextrose agar via spread plate technique. Each plate showed growth of round, white fungal colonies.



Culture

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Sample: Lymphatic

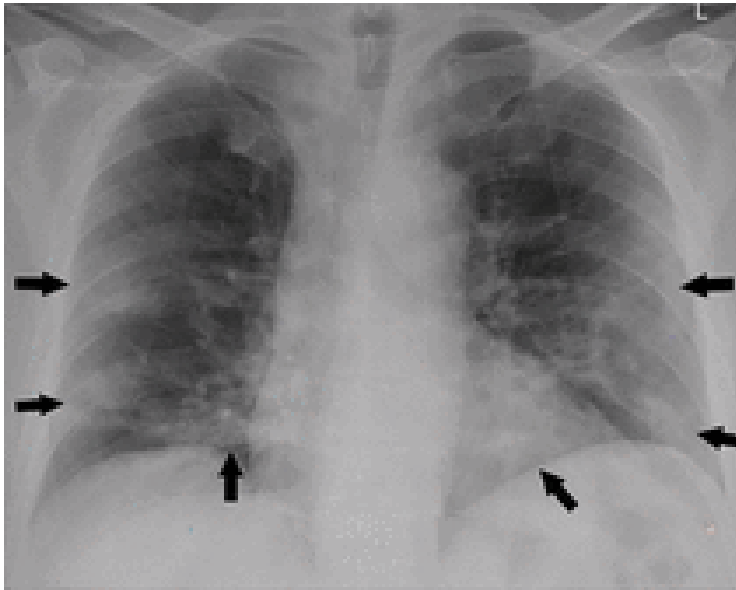
Report: Sample was diluted in PBS to appropriate concentration. 0.1 ml of diluted sample was plated on tryptic soy agar via spread plate technique and grown at 37 C. No growth was observed.

Chest X-ray Results

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46



Frontal view: Ground-glass opacities present in the mid and lower lung zones bilaterally

Complete Blood Cell Count

Patient: Jane Doe

Date Drawn: 12/5/23

Date Received: 12/5/23

Sex: F Age: 46

<u>Test</u>	<u>Result</u>	<u>Normal Range</u>
% CD38onCD8	44	36-45
CD4+ count (cells/ $\mu$ l)	902	859 - 1045
Total WCC ( $\times 10^9$ cells/l)	12.4	6.4-7.4
Hb concentration (g/dl)	13.2	13.1 - 13.9
Platelet count ( $\times 10^9$ cells/l)	292	284 - 318
ALC ( $\times 10^9$ cells/l)	2.1	1.9 - 2.3
ANC ( $\times 10^9$ cells/l)	4.0	3.7 - 4.5
% LUCs	2.0	1.8 - 2.2

CD38onCD8 = CD38 expression on CD8+ cells; WCC = white cell count; Hb = hemoglobin;

ALC = absolute lymphocyte count; ANC = absolute neutrophil count; LUCs = large unstained cells.

CT Scan Report

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

History: Dry cough for 4 days

Comparison: None

Technique: Non-contrast axial 256-multislice CT scan of the lungs was done using 3 x 1.5 mm slices.

Findings: Widespread ground-glass opacities bilaterally with a basal predominance.



Endoscopy Report

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Report:

Microscopic Description: No intestinal metaplasia is seen. No activity or dysplasia are seen. No *H. pylori* are seen.

Endoscopic Findings:

Esophagus: Normal mucosa

Stomach: RUT for *H. pylori* taken and found to be negative

Duodenum: Normal mucosa

Family Medical History

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Has any person, related by blood, had any of the following:

	<u>Yes</u>	<u>No</u>
High blood pressure	X	
Stroke		X
Heart attack before age 55		X
Blood or clotting disorder		X
Cholesterol or blood fat disorder	X	
Diabetes		X
Glaucoma		X
Epilepsy		X
Cancer (type): Lung	X	
Alcohol/drug problems	X	
Psychiatric conditions		X
Asthma		X
Serious skin disease		X

Lactic Acid Blood Test

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

<u>Test</u>	<u>Result</u>	<u>Normal Range</u>
Blood lactate concentration, mmol/L	3.8	<2.0
Maximum $\Delta$ blood lactate, mmol/L	4.4	2.6 – 3.8
Plasma lactate clearance, ml/kg/h	473	750 – 1250
Lactate production, $\mu$ mol/kg/h	1194	900 – 1500

Lipid Panel

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

<u>Test</u>	<u>Result</u>	<u>Normal Range</u>	
Cholesterol, Total:	184	100-199	mg/dL
Triglycerides	59	<150	mg/dL
HDL Cholesterol	72	>38	mg/dL
VLDL Cholesterol	12	<30	mg/dL
LDL Cholesterol	98	<100 optimal	mg/dL
		<130 near optimal	
		<160 borderline high	

Patient Interview

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Chief complaint: Patient has altered mental status, has been dry coughing for 4 days, has generalized aches, and fever. (per caregiver report)

Interview summary: Patient is a poor historian due to altered mental status. Caregiver present at bedside and was able to provide a report.

Patient lives in a long-term care facility and receives assistance from caregivers. She recently developed a dry cough and fever and has complained of general body aches and pain when urinating. Patient has had diminished appetite and poor oral intake.

Caregiver reports the patient is usually alert and oriented at baseline.

Physical Assessment

Patient: Jane Doe

Date performed: 12/5/23

Sex: F Age: 46

## Vitals:

Heart rate: 130 beats/min

Blood pressure: 86/52

Respiratory rate: 32 breaths/min

O2 saturation: 87%

Temperature: 38.4 C, 101.1 F

BMI: 17.1

Summary: Patient is oriented to person but disoriented to time and place.

Skin is pale/ashen in color.

Patient has normal S1, S2 cardiac sounds. Lung sounds are clear in upper lobes bilaterally and diminished in the lower lobes bilaterally. No adventitious lung sounds.

Dry cough noted during examination.

Active bowel sounds. Abdomen soft, non-tender. Last bowel movement was yesterday. Patient has diminished urinary output.

Pulmonary Function Tests Report

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Spirometry		Pre-Bronchodilator		
		Act	Pred	%Pred
FVC	[L]	3.51	3.86	91
FEV 1	[L]	2.51	2.76	91
FEV 1 % FCV	[%]	71.5		
PEF	[L/s]	8.74	8.03	109
FEF 50	[L/s]	2.85	3.17	93
FEF 75/25	[L/s]	2.21	2.40	92
FIF 50	[L/s]	4.36		
MVV	[L/min]		111.9	

The spirometry show a slightly reduced FVC and FEV1 with a normal FEV1/FVC ratio. The peak flow is normal. The mid expiratory flow rates are slightly reduced. The MVV is normal.

Conclusion: Patient's small airway resistance is high indicating impairment in the peripheral lung.

Selective/Differential Media Plating of Microbe

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Sample: \_\_\_\_\_

Media:

EMB: No growth

MacConkey Agar: No growth

MSA: No growth

Blood Agar: Round, white colonies

Gram stain/morphology: Because the microbe did not grow on selective plating, a simple stain was performed and cells were viewed by microscopy. Cells are round, approximately 4.0  $\mu\text{m}$  in diameter.

Notes: Culture saved for additional testing

Skin Allergy Tests

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

<u>Antigens</u>		<u>Result</u>
Insects	Cockroach	Negative
	Housefly	Negative
Pollens	Rice grain dust	Negative
	Cotton dust	Negative
	Haydust	Positive
	Parthenium hysterophorus	Negative
	Xanthium strumarium	Negative
Food items	Egg (white)	Negative
	Prawn	Negative
	Ground nut	Negative
	Milk	Negative
	Soybean	Negative
	Wheat	Negative
	Chocolate	Negative
Animal danders	Cat dander	Negative
	Dog dander	Negative

Social History

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Patient lives in a long-term care facility without notable stress for financial situation. Patient notes no use of tobacco and no use of alcohol.

Patient does not regularly exercise. Patient sleeps 7 hours per night.

Patient does not have any specific cultural requests.

Urine Culture

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Microbiology

Specimen Urine

Type of Culture Aerobic microbe incubation

Direct Smear Gram positive cocci: Negative

Gram positive bacilli: Negative

Gram negative cocci: Negative

Gram negative bacilli: Negative

Fungus: Positive

Colony Count 117

Organism Grown Unknown, culture saved for additional testing



Whole-genome sequencing

Patient: Jane Doe Date: 12/5/23

Sex: F

Age: 46

Sample type Blood

**Summary of clinically relevant variants**

<u>Chromosomal position</u>	<u>Gene</u>	<u>Phenotypes</u>
chr11:18269312:C/T:1	SAA1	Serum amyloid variant
chr11:48123823A/C:1	PTPRJ	Carcinoma of colon
chr1:145927447:C/A/T:1	GNRHR2	Radial aplasia-thrombocytopenia
chr1:22906853:G/A:1	EPHB2	Prostate cancer/Brain cancer

