A Physician vs. Artificial Intelligence

Same case. Same data. Two independent approaches to clinical reasoning.



Dr. Gurpreet Dhaliwal

Master clinician & expert in clinical reasoning

Rules of Engagement

- Both received exactly the same clinical information and imaging.
- Neither had access to the other's analysis.
- Case selected for complex clinical reasoning and broad differential.
- CaBot's response presented verbatim; errors intentionally retained to illustrate strengths and limits.



Dr. CaBot

An AI system developed using MGH Case Records

Gemini Notebook

By Aynaz Aghdasi

Presentation of Case: The Baseline

Patient: 36-year-old man.

Chief Complaint:
Admitted for abdominal pain, fever, hypoxemia, and thrombocytopenia.



T-Minus 2 Weeks:
Dull, mild pain developed in right lower abdomen and right lower back.
History of alcohol use disorder (binge drinking).



Patient: 36-year-old man.

System Log – T-Minus 5 Days

DATA INTEGRITY CONFIRMED

SYSTEM LOG

Symptoms logged:
Myalgias, subjective fever.

Urgent Care Eval:
Physical exam normal.

Pathogen Screens:

Urinalysis	SARS-CoV-2	Influenza A/B
[NEGATIVE]	[NEGATIVE]	[NEGATIVE]
✓	✗	✗

Intervention:
IV fluids + ketorolac administered.

Outcome: Resolution of abdominal pain; discharged home.

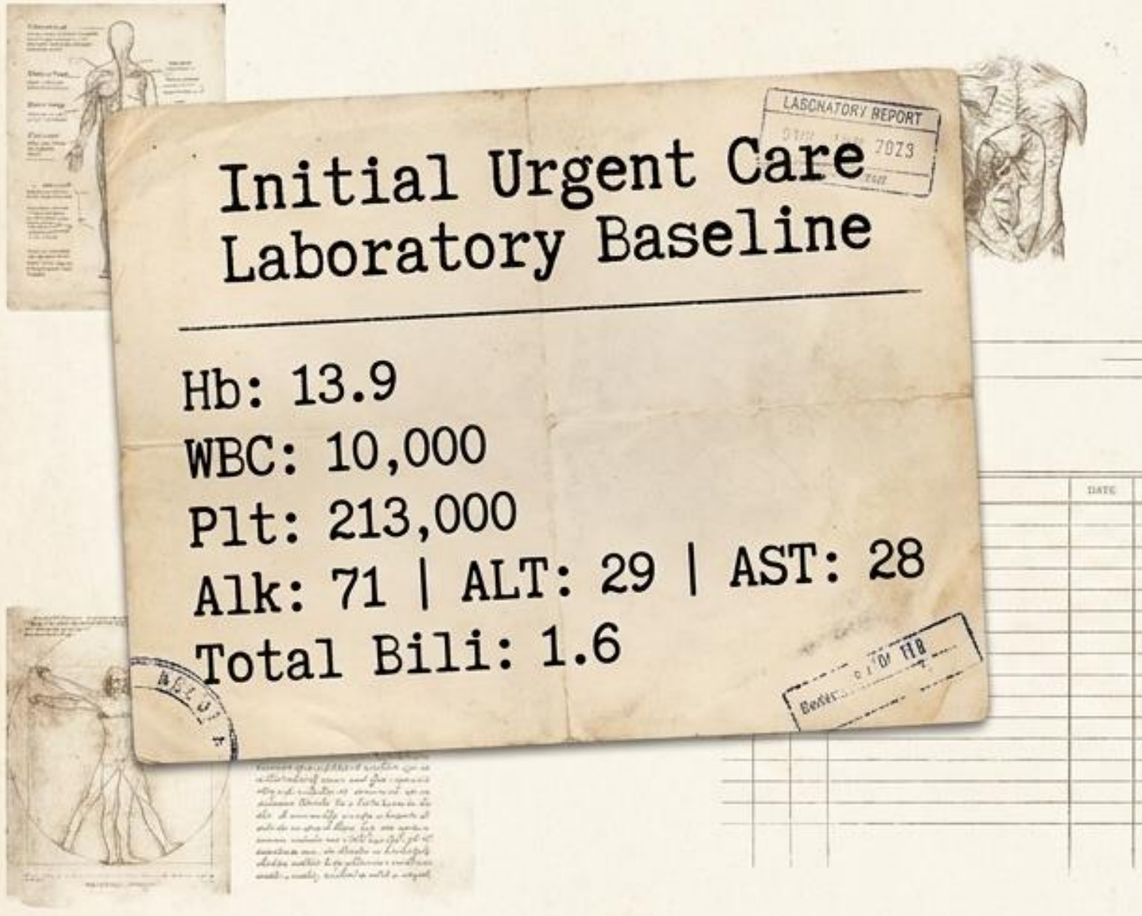
Digital Signature

DIAGNOSTIC PATHWAY: NEGATIVE

100
75
50
25
0

Gemini Notebook

Human Clinician



WBC Differential Breakdown



Gemini Notebook

Clinical Progression & The Crisis

Timeline (3 Days Prior):
Recurrent abdominal pain with diarrhea, unresponsive to acetaminophen/ibuprofen.

Timeline (1 Day Prior):
Developed nausea, vomiting, dyspnea, and cough.

Current Urgent Care Status:
Ill-appearing, increased work of breathing. Crackles, scleral icterus, RUQ tenderness with guarding.



Vitals Crash Log:



SpO_2: 85% on room air -> Improving to 98% with 4 L/min O_2

HR: 115

BP: 89/64



Intervention: 2 L IV fluids administered.

Result: Hypotension worsened to 78/60 mm Hg.

Action: Emergency transfer to ED.



Gemini Notebook

Comprehensive History Formulation

Human Clinician



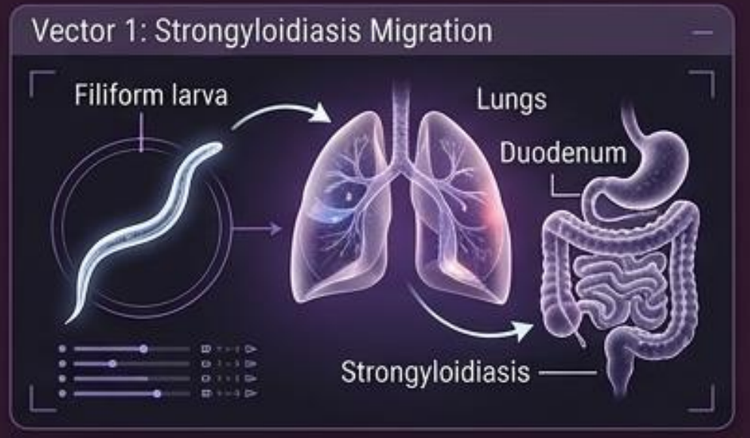
Social History:

Born in Central America;
U.S. x16 years.
Construction worker.
Lives with partner/2 children.
Lifelong nonsmoker;
no illicit drug use.

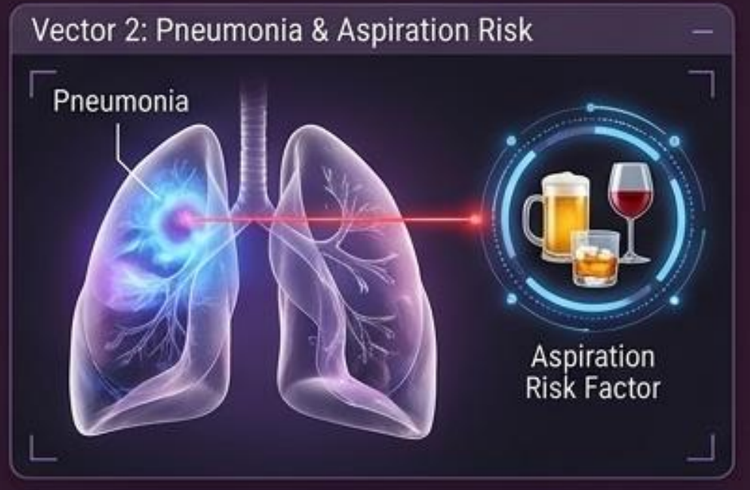
HPI Additions:

Persistent intermittent fever since prior visit.
Abdominal pain (no clear aggravating/relieving factors).
Productive cough with tan sputum.

AI



Lifecycle & Pathogen Movement



Algorithmic Link: Substance Use & Complications

Past Medical History (PMH):
Alcohol use disorder (4-5 beers/weekday; up to 12/weekend).
Prior naltrexone (discontinued 3 mos ago).
GERD (pantoprazole, asymptomatic).

Past Medical History (PMH):
Alcohol use disorder (4-5 beers/weekday; up to 12/weekend).
Prior naltrexone (discontinued 3 mos ago).
GERD (pantoprazole, asymptomatic).

Meds/Allergies/Family:
No current meds.
No ADRs.
No personal/family history of VTE.

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ED Physical Examination

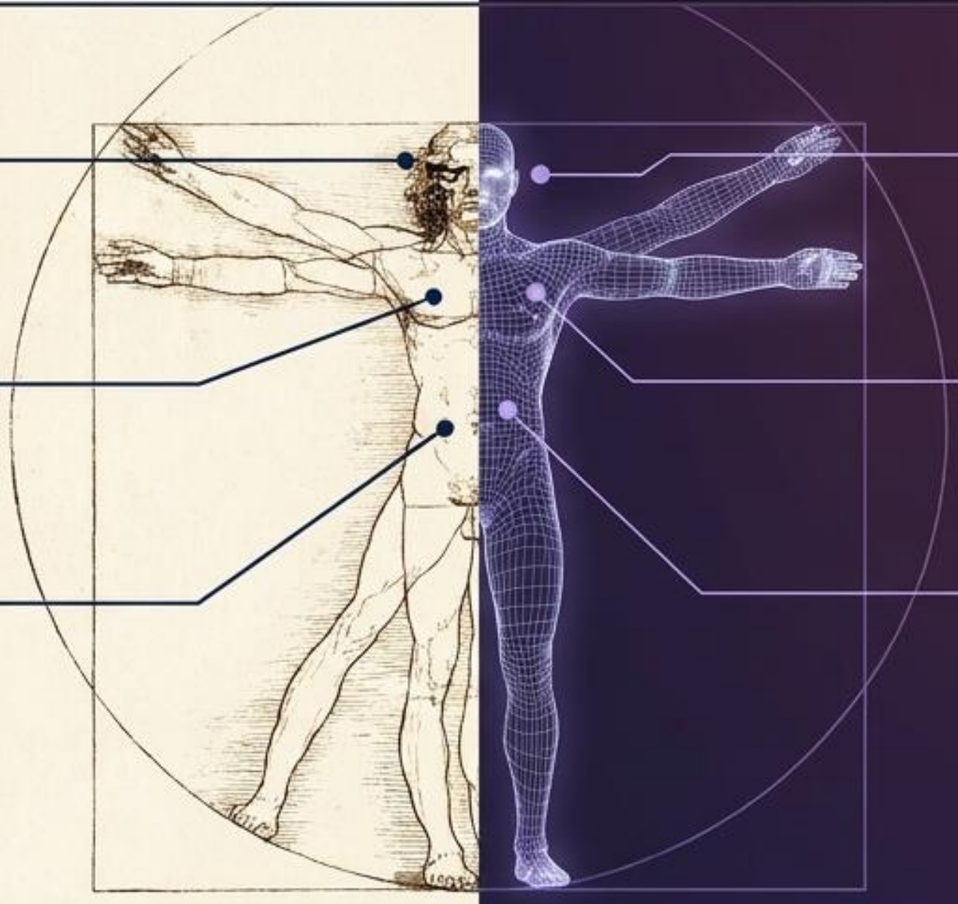
Human Clinician

T: 38.6°C | **BP**: 92/50 | **HR**: 110 | RR: 28 | SpO_2: 94% on 4L O_2

Eyes:
Scleral icterus

Lungs:
Bilateral posterior crackles

Abdomen:
RUQ tenderness
(without inspiratory worsening)



Pertinent Negatives: *No asterixis, petechiae, oral ulcers, dental infection, edema, rash, or skin breakdown.*

ED Physical Examination

AI

Eyes:
Scleral icterus

Lungs:
Bilateral posterior crackles

Abdomen:
RUQ tenderness
(without inspiratory worsening)

Pertinent Negatives: No asterixis, petechiae, oral ulcers, dental infection, edema, rash, or skin breakdown.

Gemini Notebook

Emergency Department Laboratory Shift

Human Clinician

Classic Diagnostic Panel

Hematology:

Hb: 13.1 g/dL	WBC: 4,700 /µL
Plt: 24,000 CRASH /µL	Retic: 0.8%

Hepatic:

Alk: 464 U/L	ALT: 28 U/L	AST: 38 U/L
Total Bili: 3.4 mg/dL	Direct Bili: 3.2 mg/dL	

AI

Algorithmic Lab Analysis

Coagulation:

PTT: 27.8 s	INR: 1.2	PT: 13.5 s
D-dimer: >7650 ng/mL (FEU)	Fibrinogen: 727 mg/dL	

Inflammatory/Tissue:

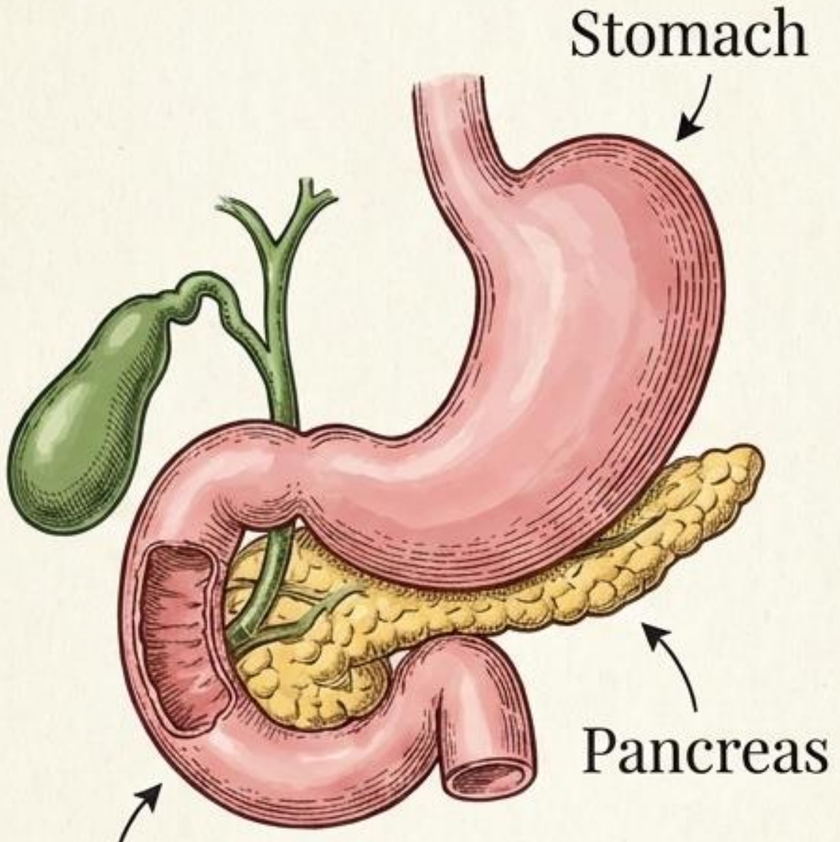
Lipase: 15 U/L	LDH: 747 U/L
Haptoglobin: 226 mg/dL	Ferritin: 767 ng/mL
Lactic Acid: 2.5 mmol/L	CRP: 325.2 mg/L

Metabolic:

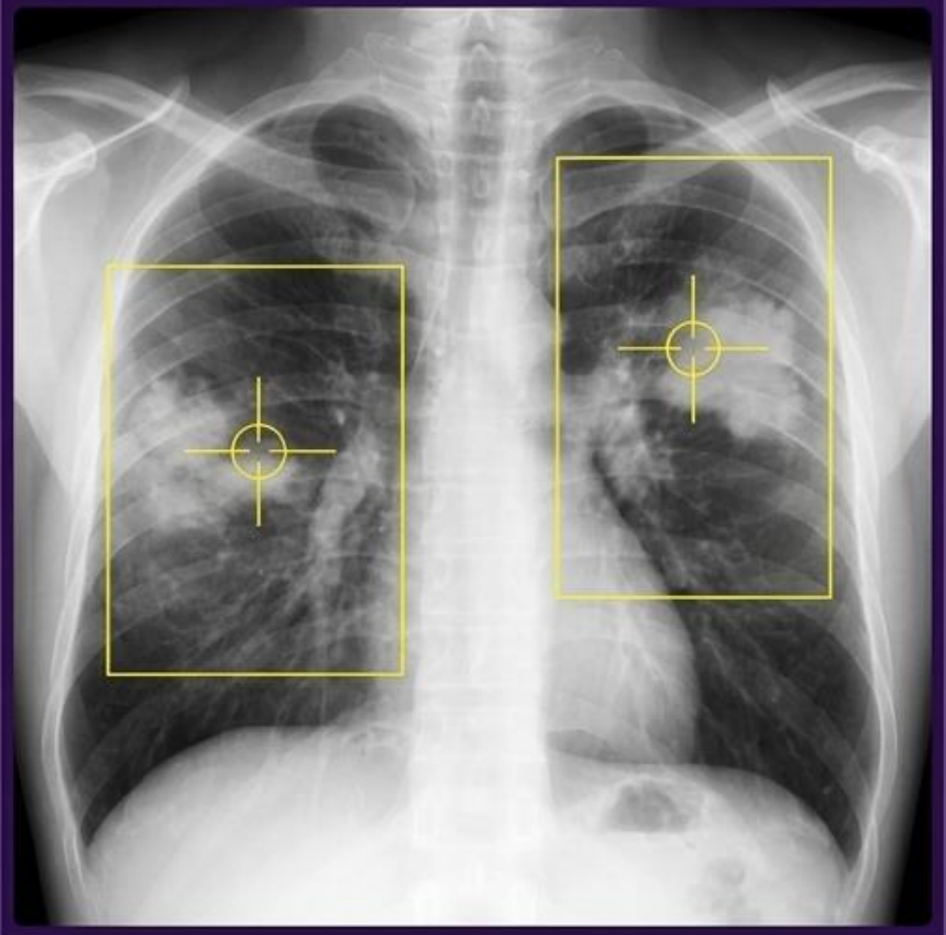
Na: 140 mmol/L	K: 3 mmol/L	Cl: 109 mmol/L
Urea: 23 mg/dL	Cr: 0.98 mg/dL	

Gemini Notebook

Chest Radiography & Hemodynamic Response



Hemodynamic Update:
Action: Two additional liters of IV fluids administered.
Result: Blood pressure increased to 116/59 mm Hg.
Additional imaging ordered.



Radiology Readout:
- Engorged, indistinct pulmonary vasculature.
- Reticular opacities in both lungs.
- Patchy airspace opacities (predominantly in lower lobes).

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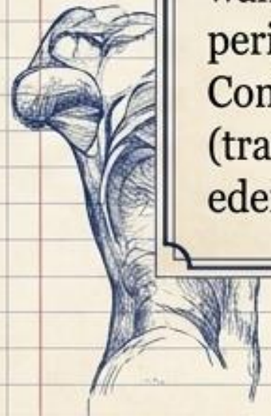
CT Chest, Abdomen & Pelvis Findings

CT Chest, Abdomen & Pelvis Findings



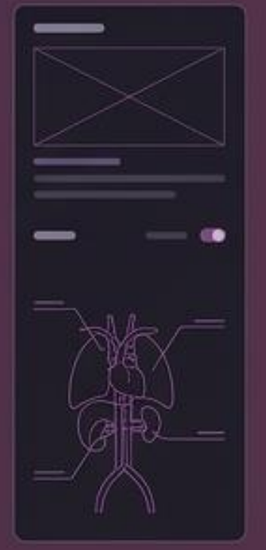
Chest: Multifocal patchy opacities (post RUL/lower lobes). Bilateral interlobular septal thickening. Trace effusion. Mediastinal LAD (right hilar, perivascular, subcarinal). No PE.

Hepatic/Biliary: Hepatomegaly with diffuse periportal edema. Bile duct wall thickening + periportal LAD. Contracted gallbladder (trace pericholecystic edema).





Vascular: Partially occlusive right renal vein thrombus extending into IVC.



GI: Subtle proximal duodenal wall thickening with mucosal hyperemia. Possible soft-tissue connection between duodenum and right kidney.



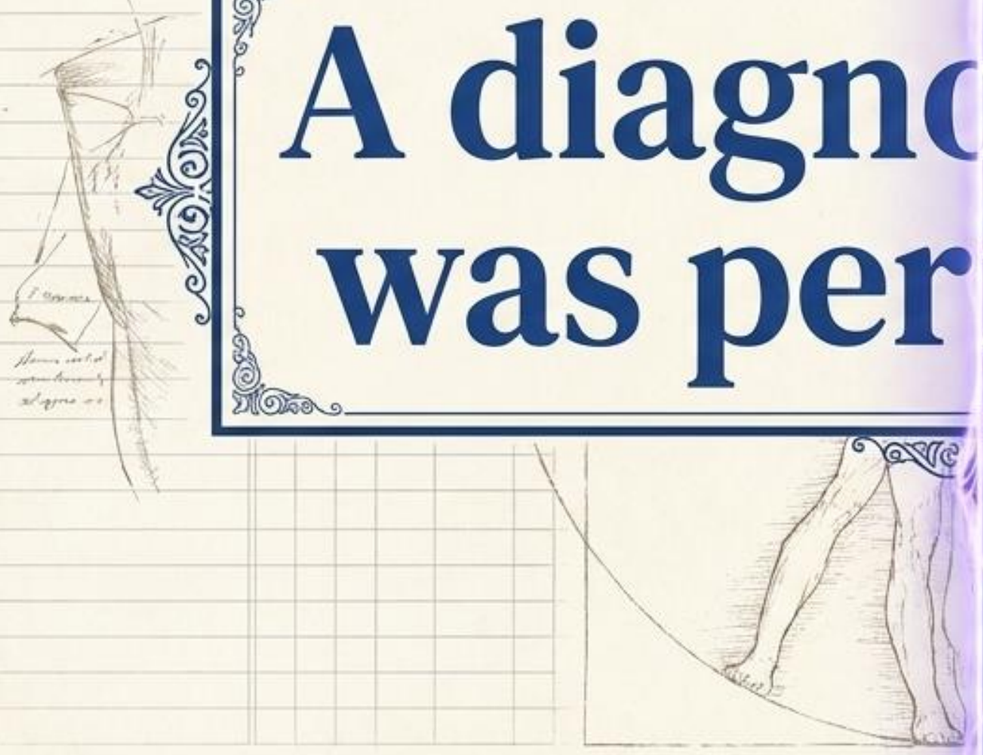


Next Step: Abdominal MRI recommended

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Hospital Day 2

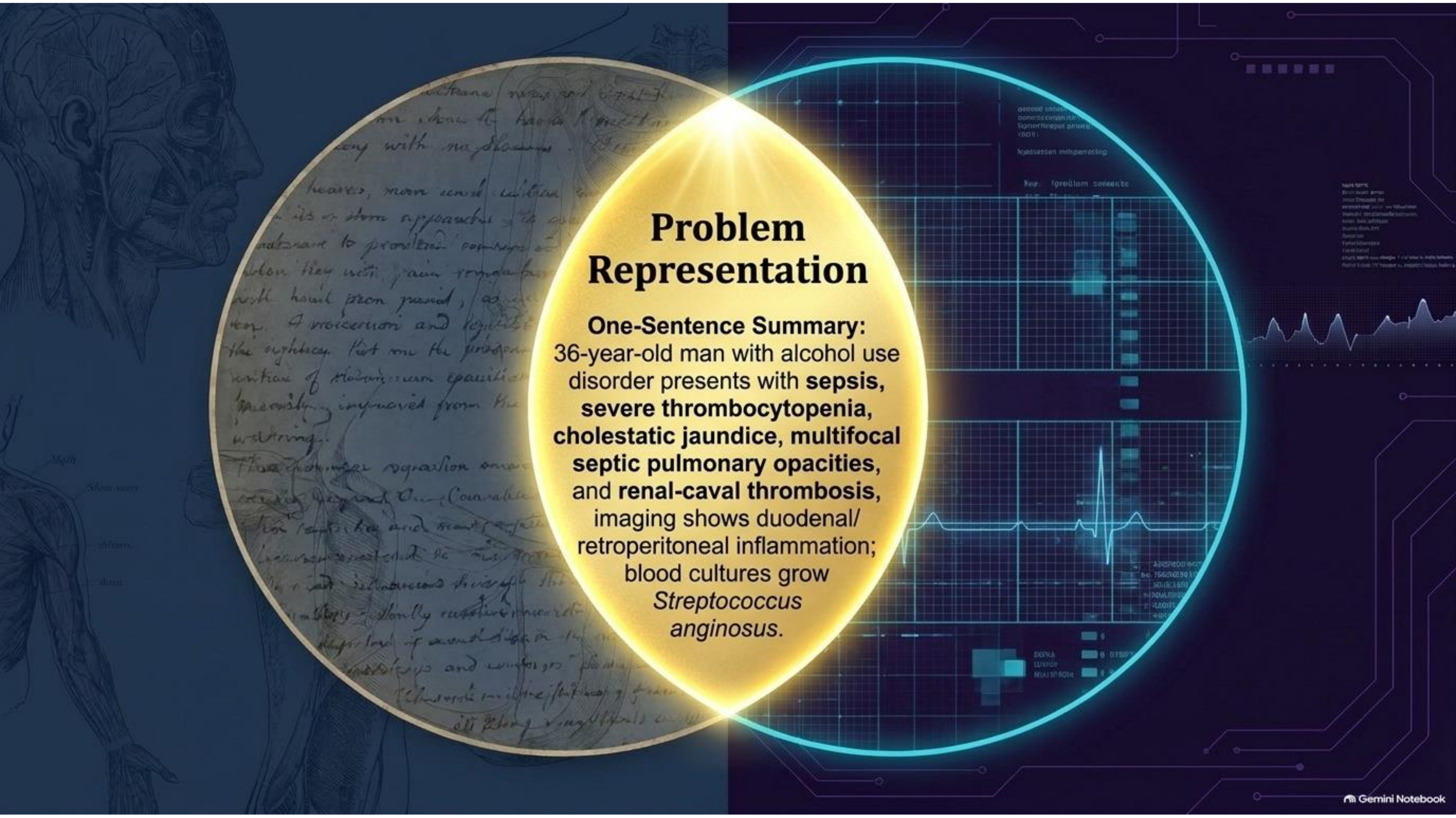
Status Update: Persistent high-grade fever (39.0°C).



A diagnostic test was performed.

The data is set. Dr. Dhaliwal and Dr. CaBot will now present their reasoning.

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Gemini Notebook

The Diagnostic Duel

-2wk

Abdominal pain



Back pain



-3d

Abdominal pain



Diarrhea



-1d

Sepsis

Dyspnea

Hypoxia

ED

Fever

Airspace Opacities

Duodenum

Thrombosis

+1d

T = 39.2

S. anginosus

Gemini Notebook

Patient Dossier



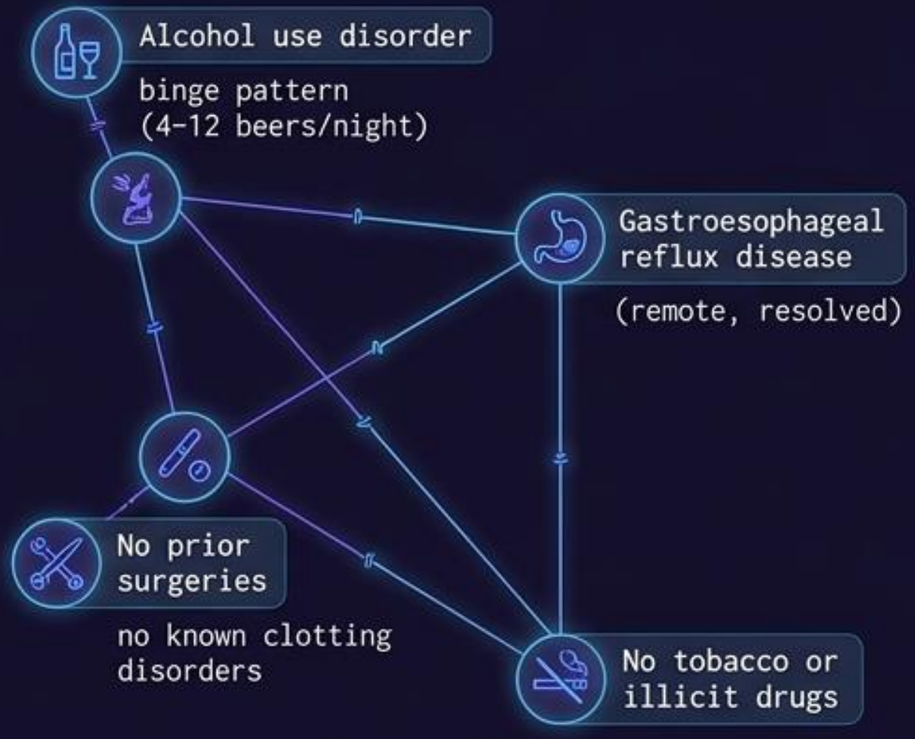
Social Context

Construction worker; born in Mexico, living in Boston for 16 years.

Monogamous relationship.



EHR Risk Calculation



Medical Vectors

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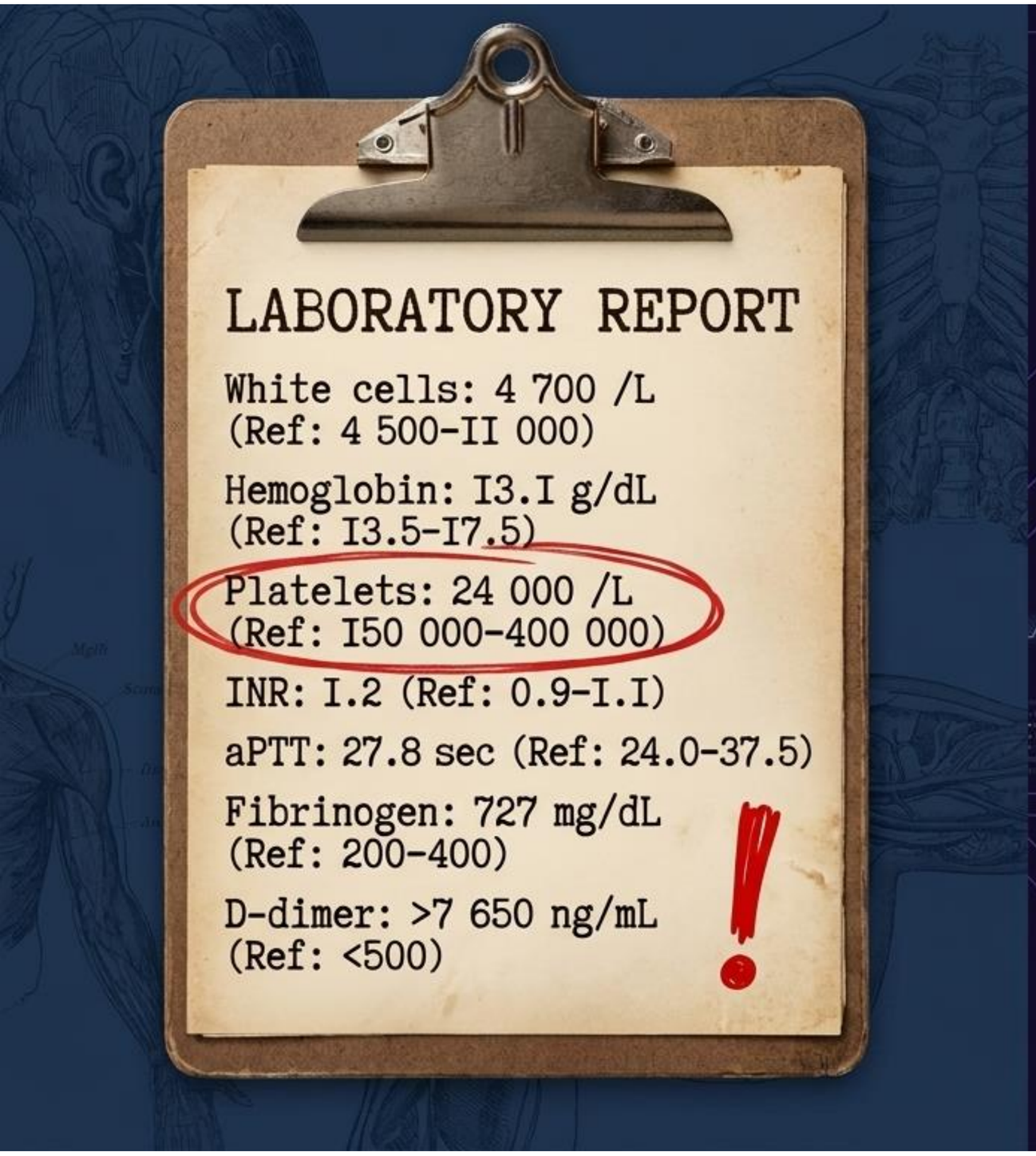
Bedside Exam:

- **Eyes:** Icteric sclerae. ✓
- **Neuro:** No asterixis. ✓
- **Pulmonary:** Bilateral crackles posteriorly. ✓
- **Abdomen:** Right-upper-quadrant tenderness without inspiratory arrest. ✓
- **Skin/Mucosa:** No edema, rash, or mucosal bleeding. ✓

Vitals Monitor:

Temp	38.6 °C
BP	92/50 mm Hg (↑116/59 after fluids)
Pulse	110 bpm
RR	28 /min
SpO2	94

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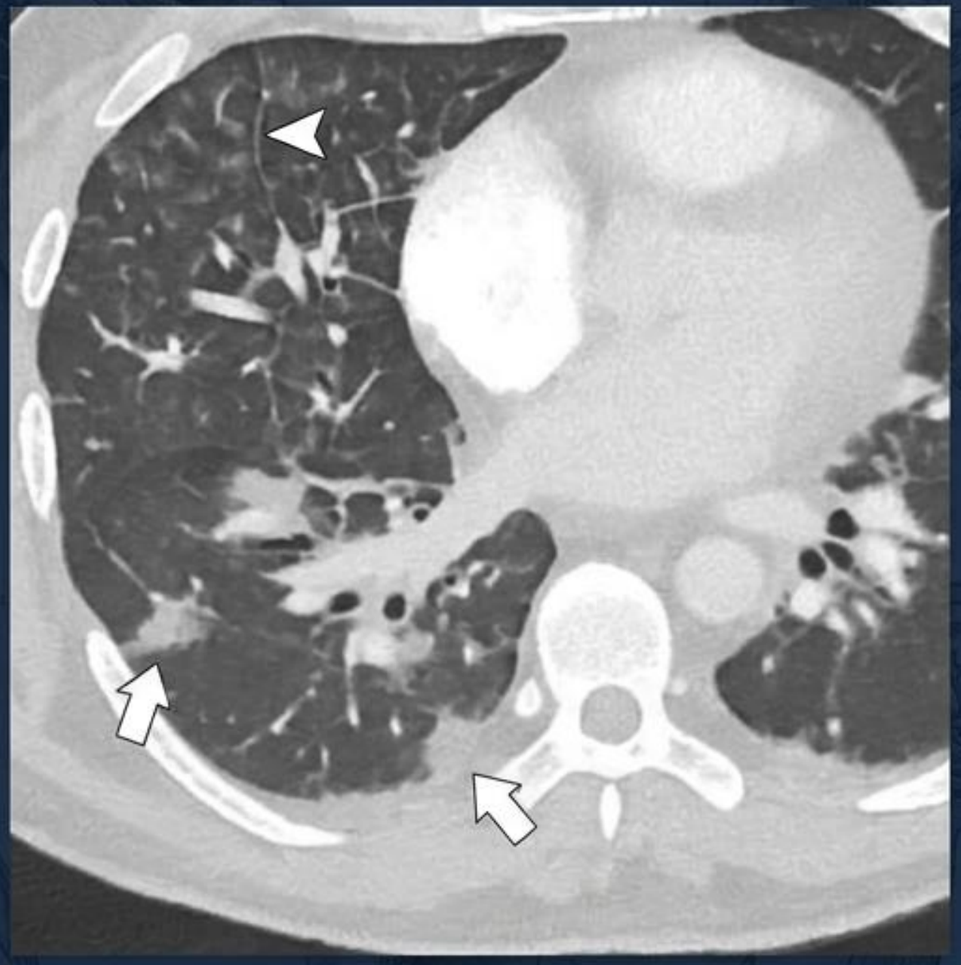


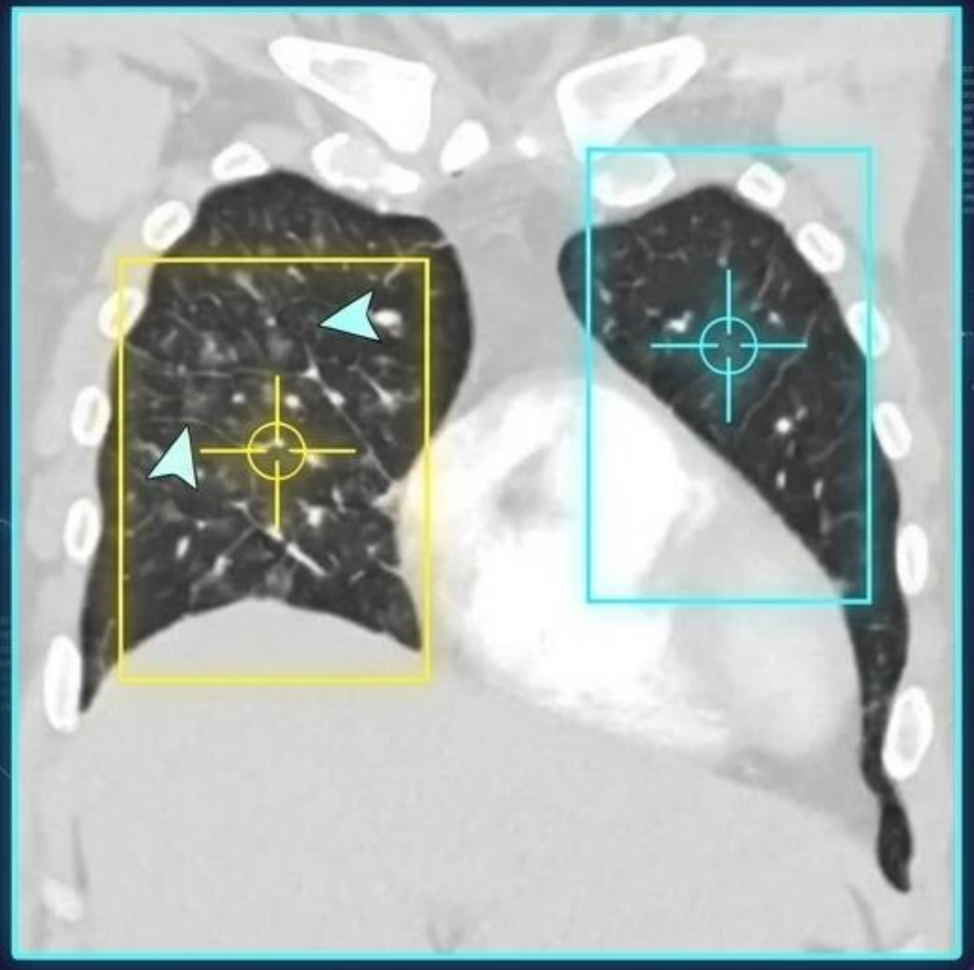
Lab Results (Digital Array)

- Alkaline phosphatase: 464 U/L (Ref: 45-145)
- Total bilirubin: 3.4 mg/dL (Ref: 0.2-1.0)
- Direct bilirubin: 3.2 mg/dL (Ref: 0.0-0.3)
- LDH: 747 U/L (Ref: 110-210)
- CRP: 325 mg/L (Ref: <8)
- Creatinine: 0.98 mg/dL (Ref: 0.60-1.50)
- Sodium: 140 mmol/L (Ref: 135-145)

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Chest CT: Axial and Coronal Views





Multifocal peripheral opacities with tree-in-bud nodularity.

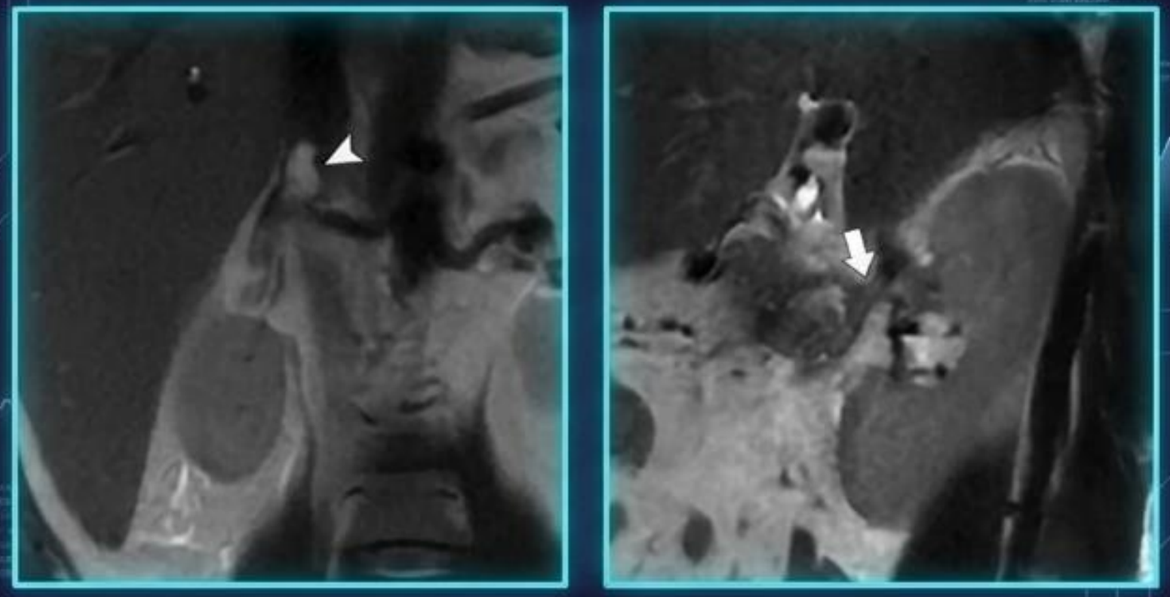
Gemini Notebook

Abdominal CT with Contrast



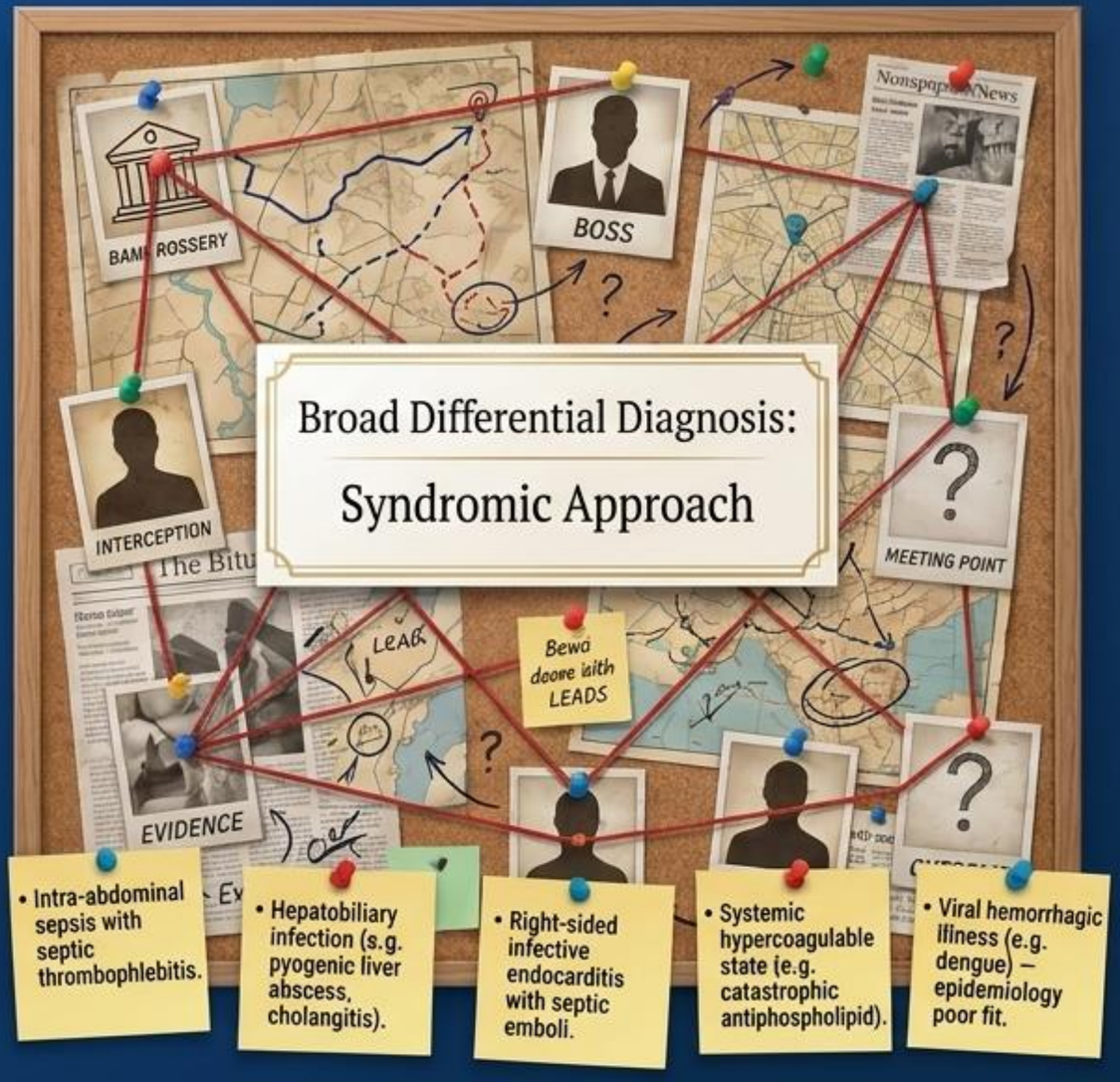
Periportal edema and partially occlusive right-renal-vein thrombus.

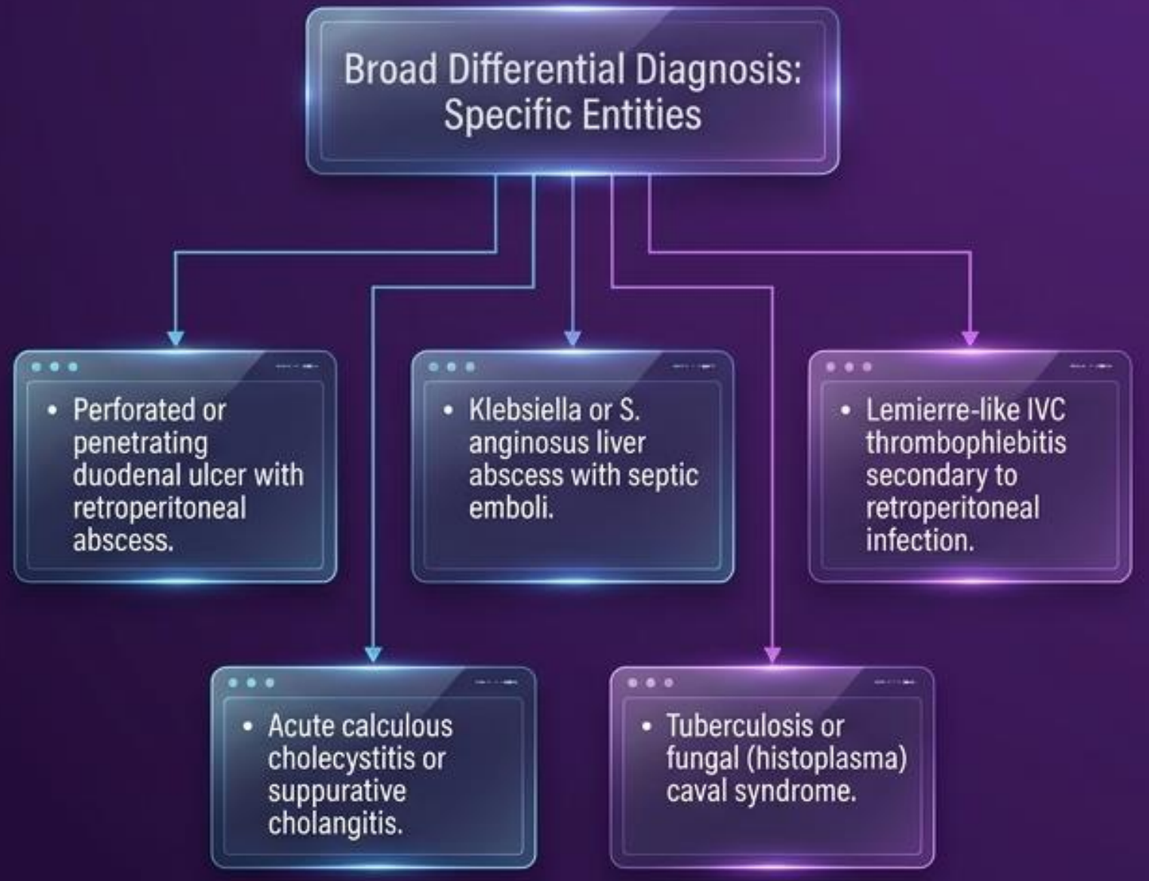
Abdominal MRI



Duodenal wall thickening with contiguous inflammatory mass.

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Gemini Notebook

Clinical Reasoning

- *S. anginosus* — strong predilection for abscess formation along GI tract & liver.
- Chest CT pattern favors septic emboli over typical pneumonia.
- Right-sided endocarditis possible but less common with *milleri* group; no murmurs, renal-caval thrombus more parsimonious.
- Lupus anticoagulant positivity probably transient, infection-related.

Pathophysiological Logic

- Non-occlusive thrombus in right renal vein/IVC offers embolic source.
- Periportal edema and biliary wall thickening likely reactive congestion rather than primary biliary obstruction.
- Duodenal wall edema with soft-tissue track to renal hilum suggests retroperitoneal phlegmon/abscess.
- Thrombocytopenia with elevated fibrinogen + very high D-dimer = sepsis-associated DIC, explaining bleeding risk and clot propagation.

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Working Diagnosis

Perforated or penetrating duodenal process with retroperitoneal abscess due to *Streptococcus anginosus*, complicated by septic thrombophlebitis of the right renal vein and IVC with septic pulmonary emboli

Key supporting data:

- *S. anginosus* bacteremia—classic abscess former.
- Duodenal/ retroperitoneal inflammatory mass on CT/MRI.
- Infected renal-caval thrombus anatomically contiguous.
- Multifocal peripheral lung lesions consistent with showered emboli.

Gemini Notebook

Next Steps: Diagnostic Protocol

1. Esophagogastroduodenoscopy (EGD) ± endoscopic ultrasound to identify penetrating ulcer or intramural abscess.

2. Image-guided (CT or ultrasound) aspiration of retroperitoneal collection—culture & drainage.

3. Transthoracic then transesophageal echocardiography to exclude occult endocarditis (sensitivity 90).

Next Steps: Therapeutic Protocol

- Continue high-dose ceftriaxone (excellent activity vs. *milleri* group) ± metronidazole for anaerobes.
- Early percutaneous drainage or surgical debridement for definitive source control.
- Therapeutic heparin for septic thrombophlebitis—monitor platelets and coagulation closely.
- Escalate to broad coverage only if cultures nonresponsive; de-escalate per susceptibilities.

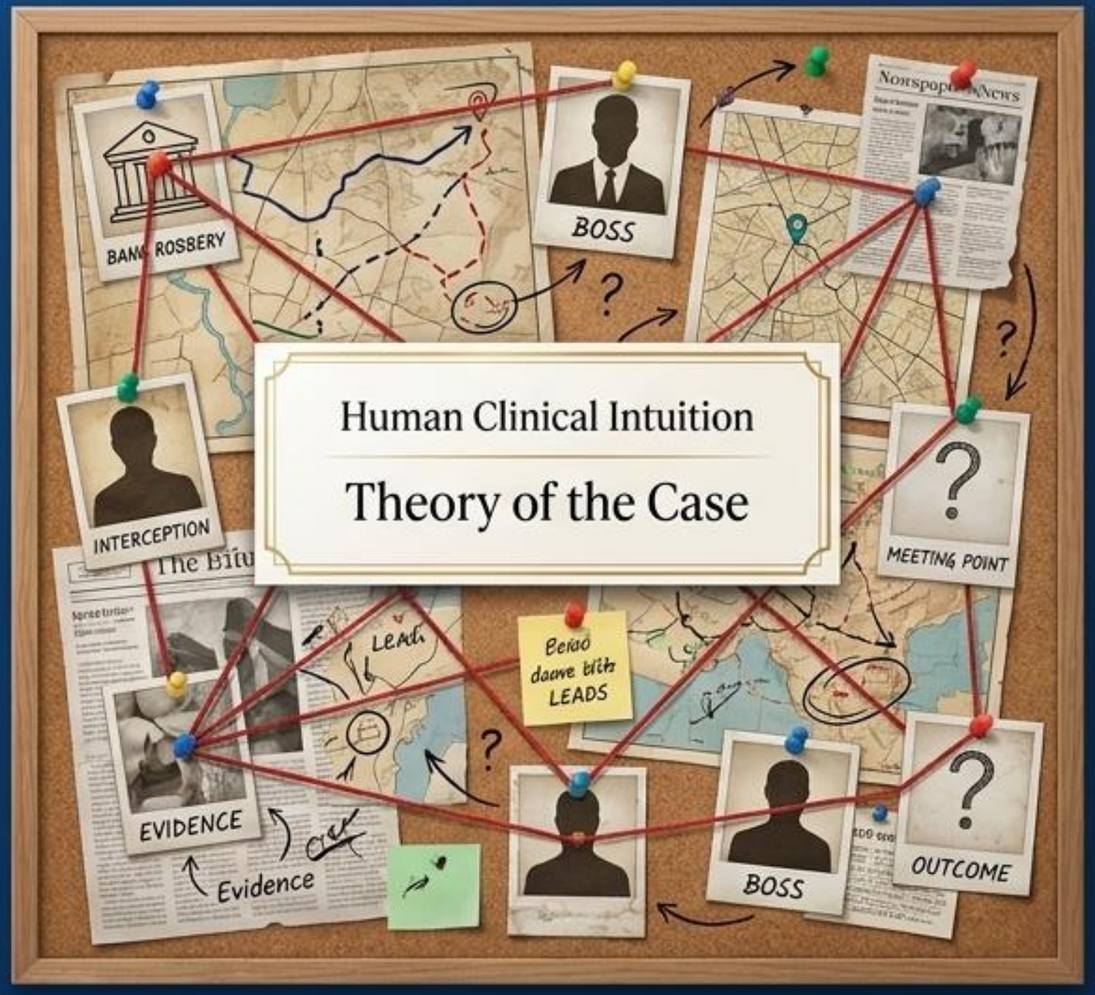
Gemini Notebook

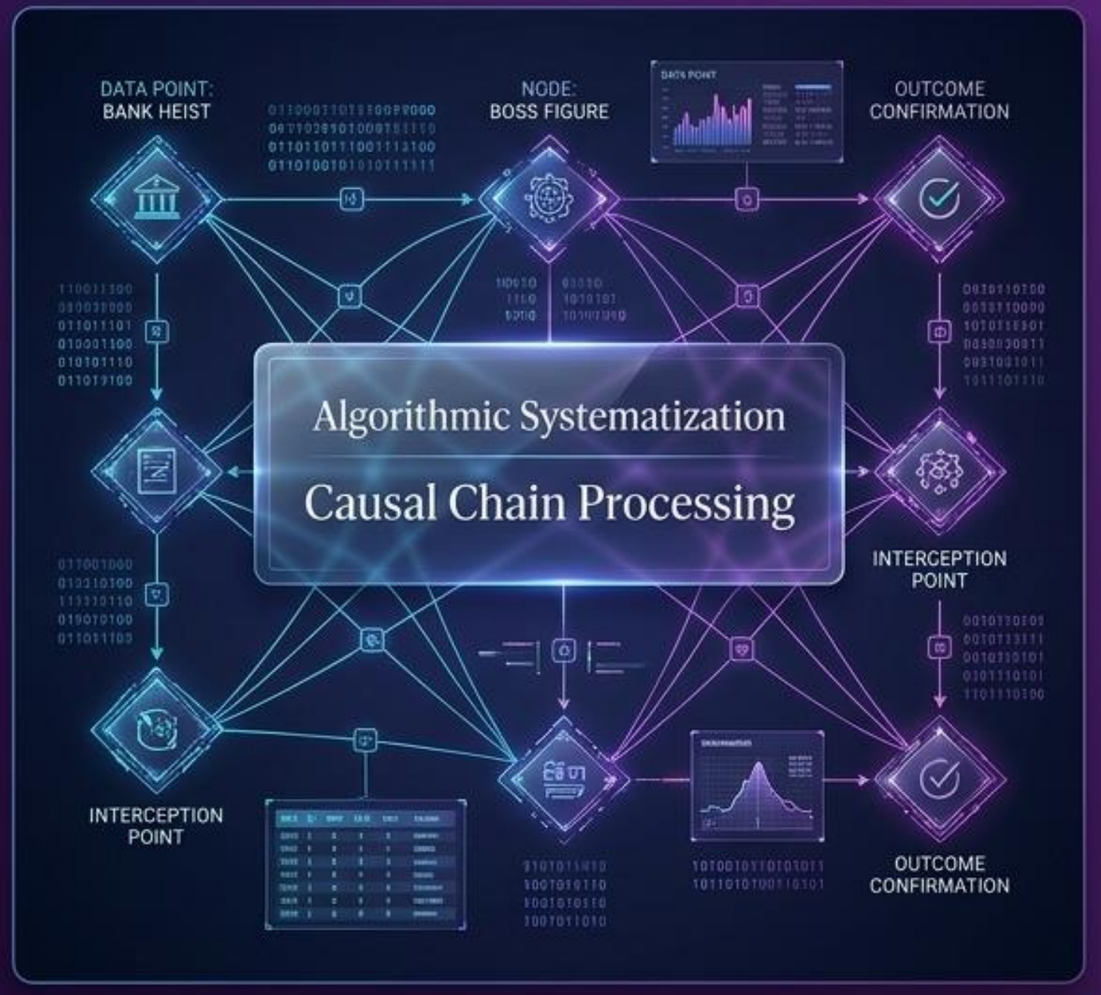
Teaching Points

1. *S. anginosus* bacteremia should trigger a hunt for a concealed abscess.
2. Septic thrombophlebitis can arise in the IVC/renal vein—an abdominal variant of Lemierre syndrome.
3. Multifocal peripheral opacities with tree-in-bud on CT signal septic emboli, not routine pneumonia.
4. Severe thrombocytopenia with high fibrinogen and D-dimer often represents early DIC in sepsis.
5. Definitive management hinges on source control—antibiotics alone are seldom curative.

Gemini Notebook

Theory of the Case: A Diagnostic Duel





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GI – abdominal pain | diarrhea | duodenopathy

Pulmonary – dyspnea | hypoxia | cough | opacities

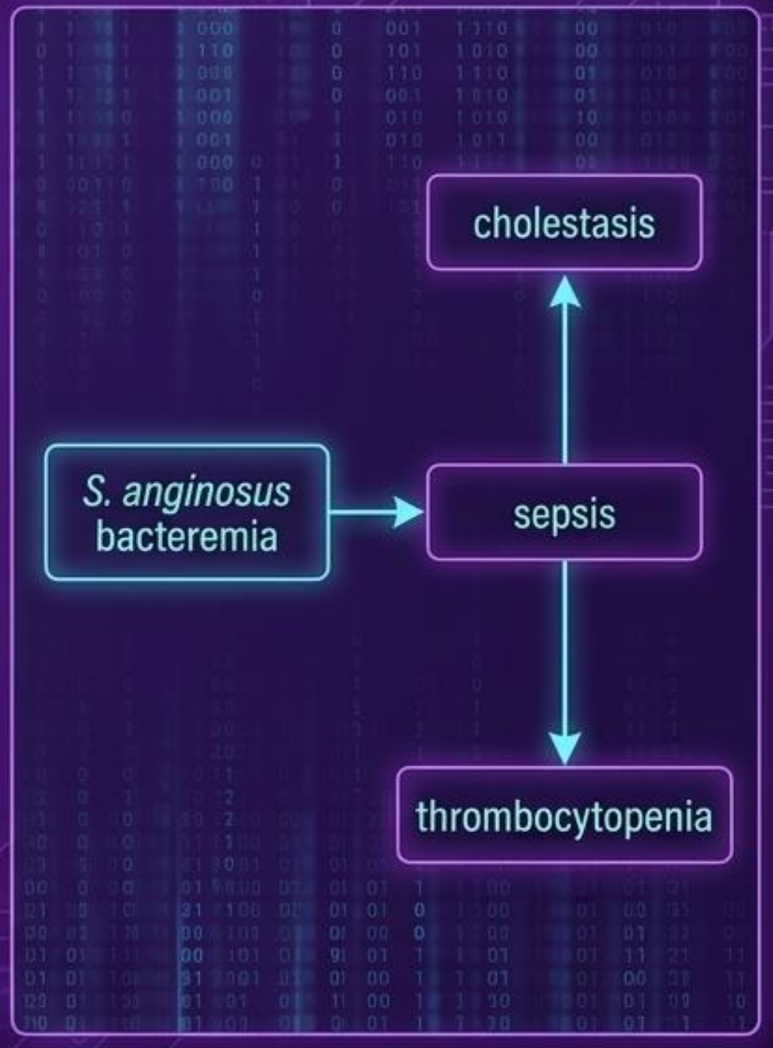
Lymphadenopathy – thoracic | abdominal

Heme – thrombosis | LAC+ | thrombocytopenia

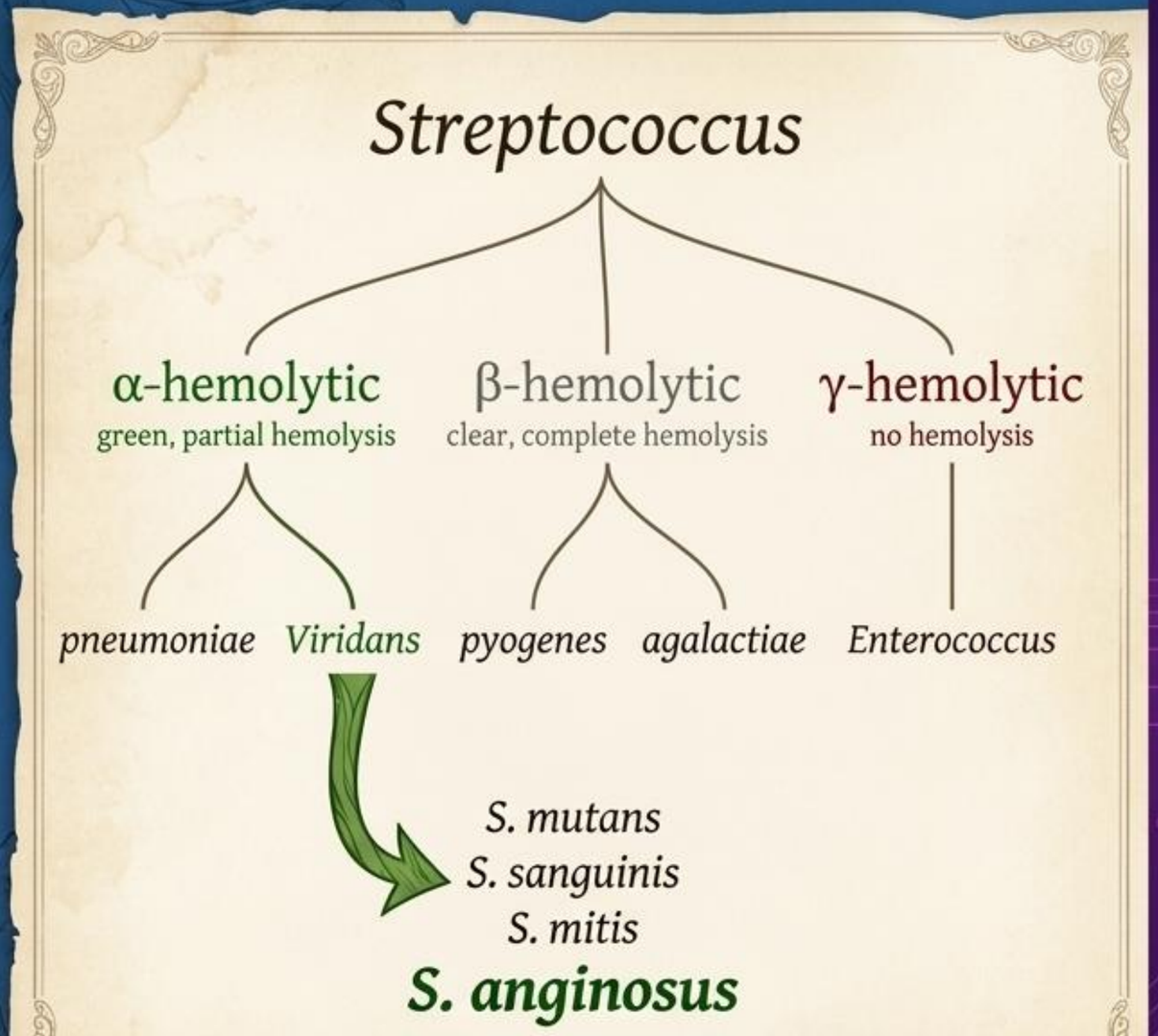
Hepatic – hepatomegaly | ↑ bilirubin/alk phos

ID – *S. anginosus* bacteremia





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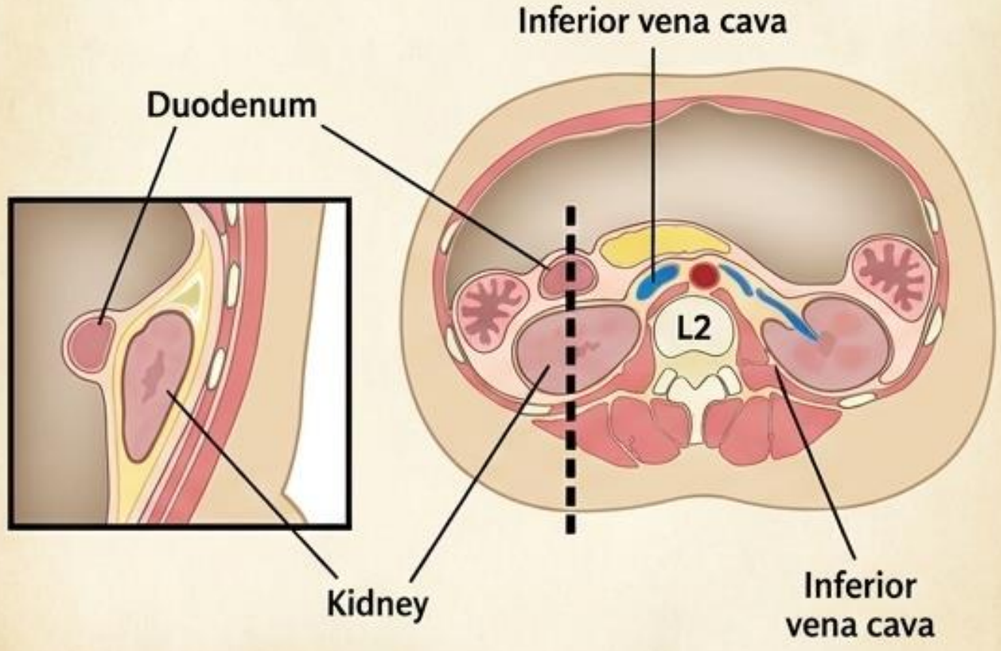
HANDOC Score

A Handy Score to Determine the Need for Echocardiography in Non-β-Hemolytic Streptococcal Bacteremia

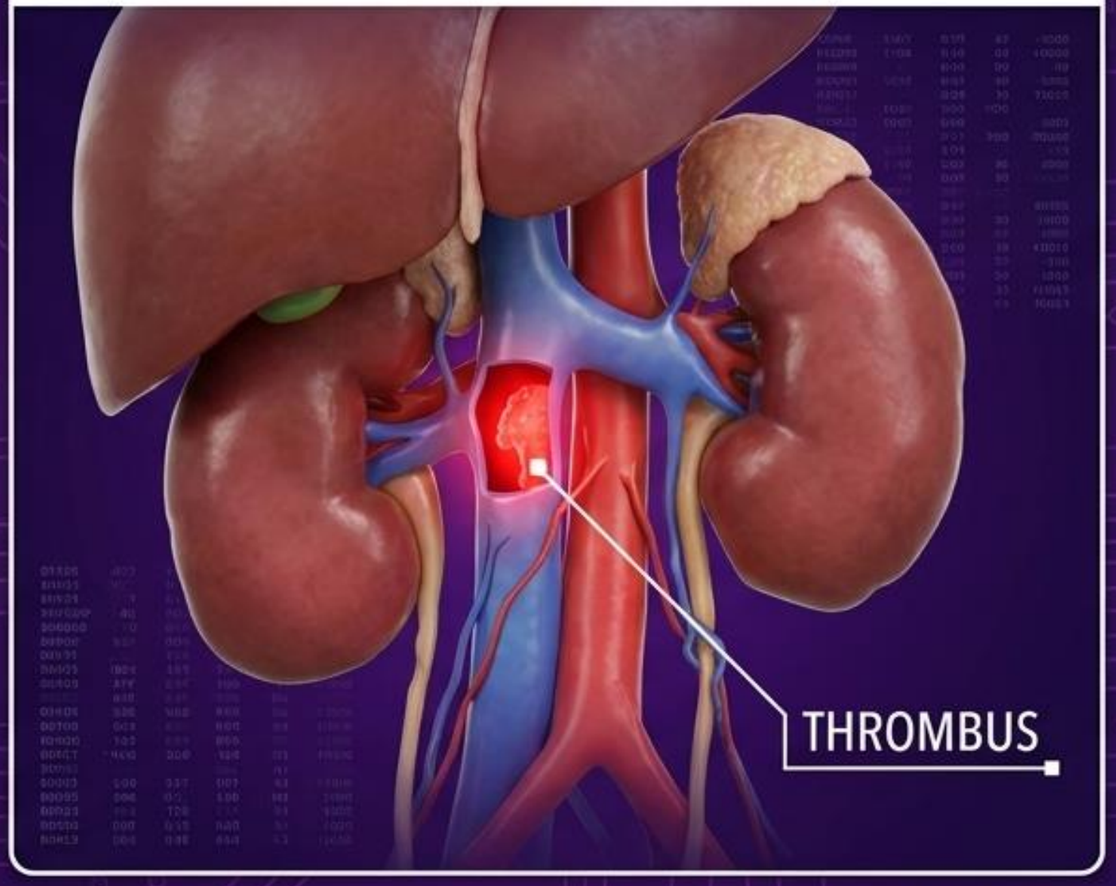
1	+1 point	S. bovis, S. sanguis, S. mutans
2	+0 points	(all others)
3	-1 point	S. anginosus

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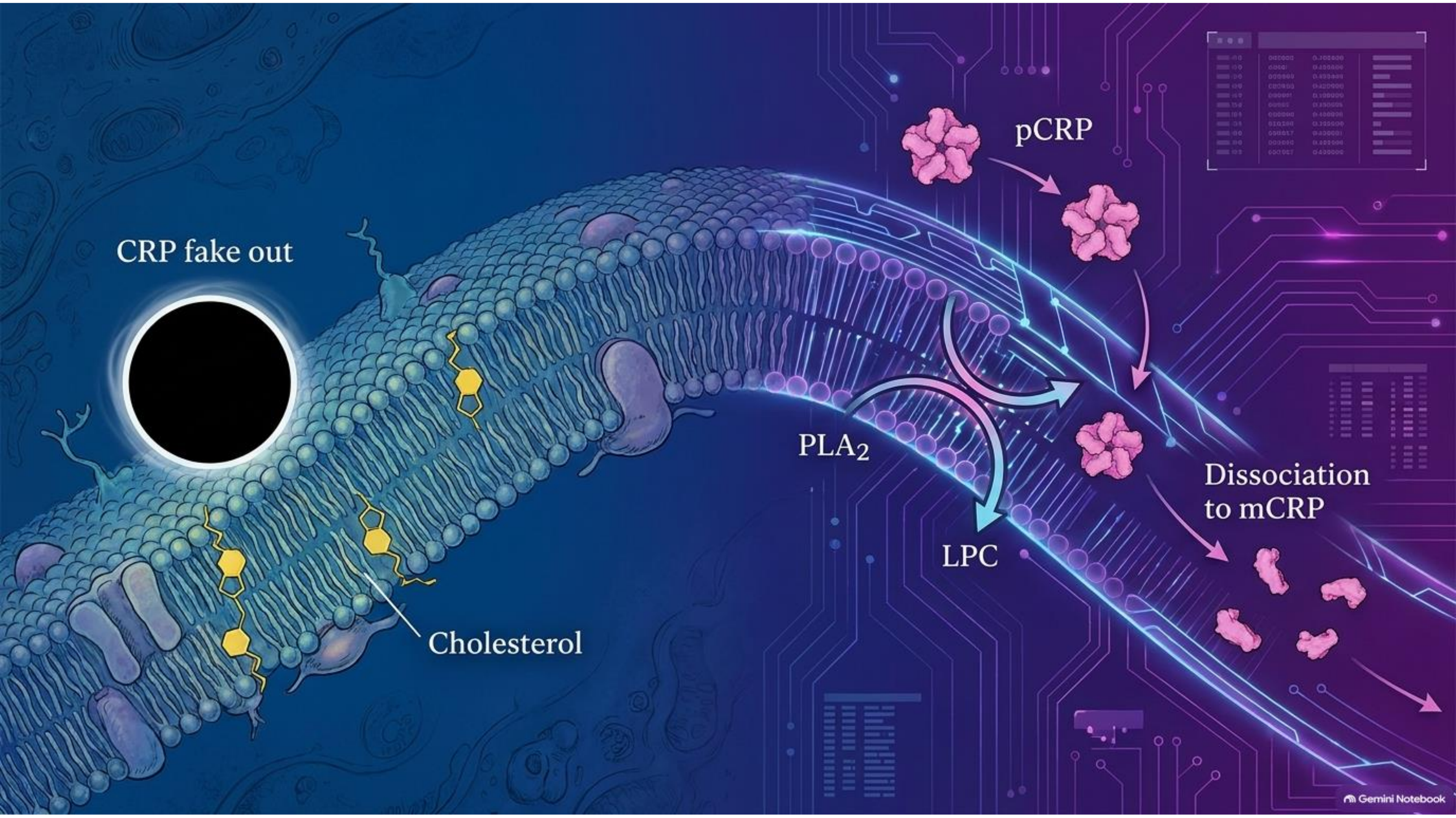
THE DIAGNOSTIC DUEL



DIGITAL PRECISION | CORONAL VIEW

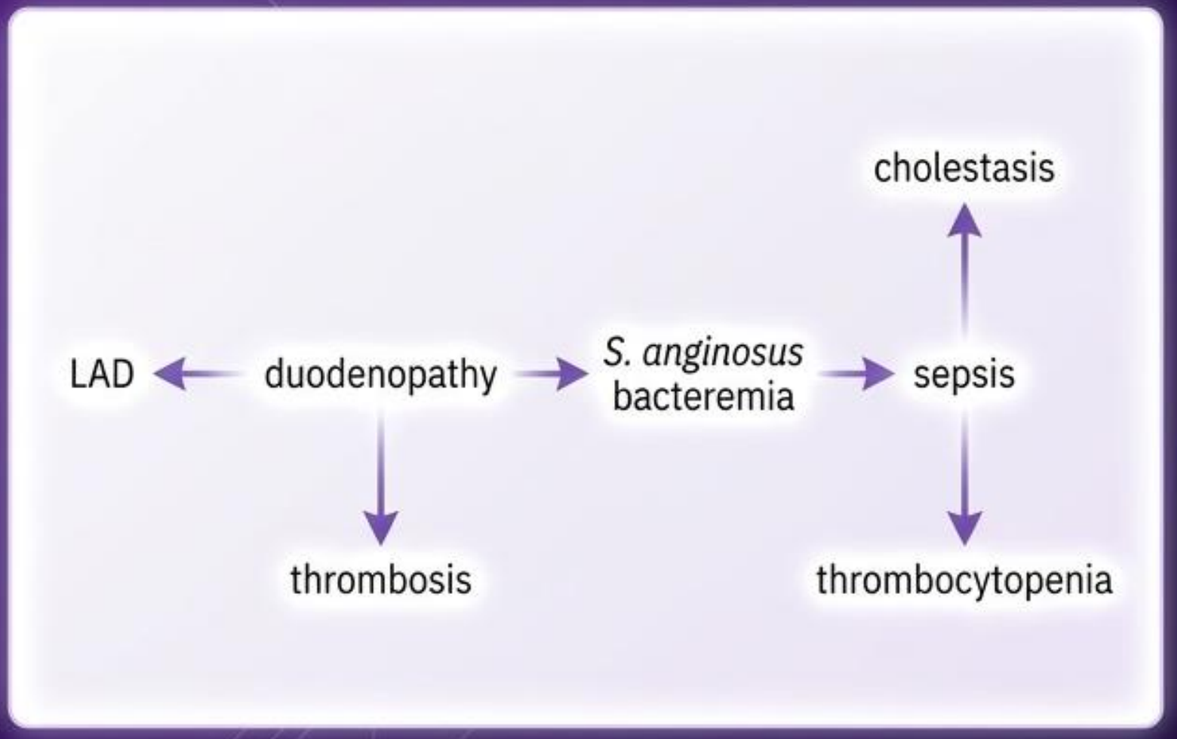


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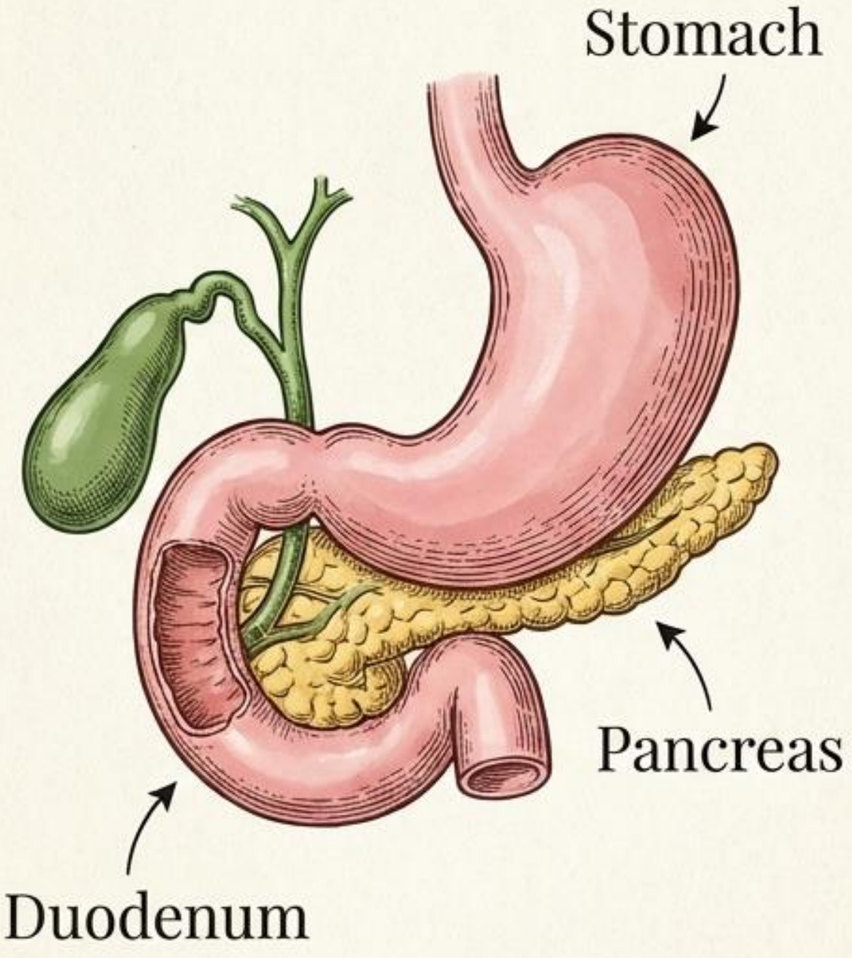

CRP fake out
pCRP
PLA2
LPC
Dissociation
to mCRP
Cholesterol
Gemini Notebook

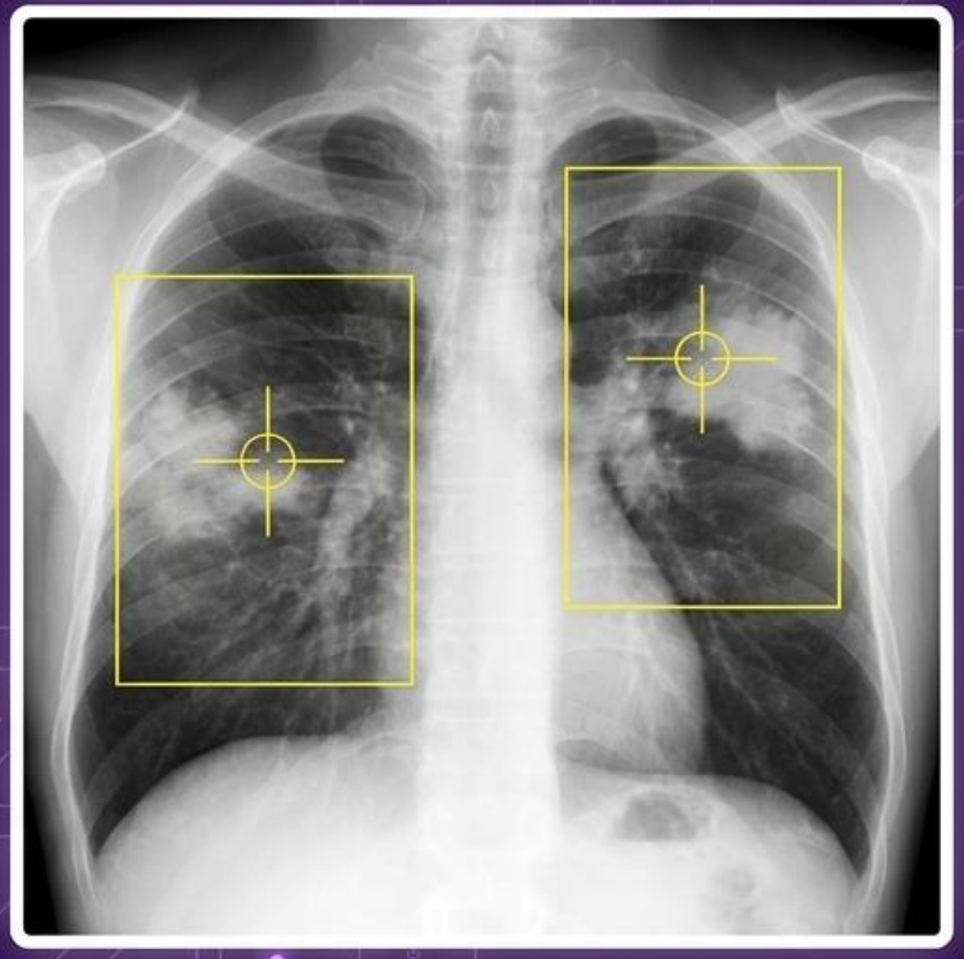
duodenum?

Category	Hypothesis	
Ischemia		✗
Inflammatory	IBD	✗
Infection	*H. pylori* -> ulcer	✗
Infiltration	Lymphoma	✗



Gemini Notebook





Gemini Notebook

Social History & Context



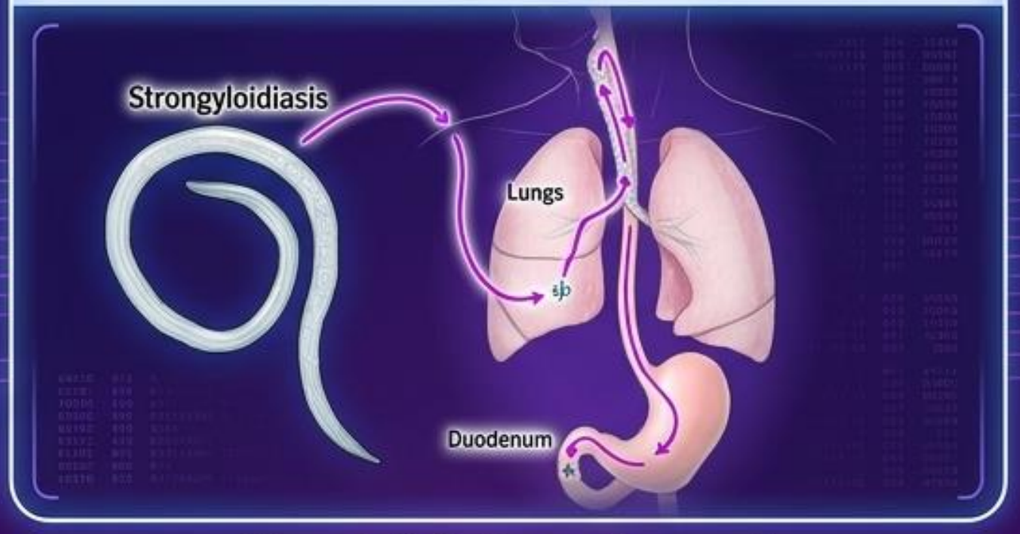






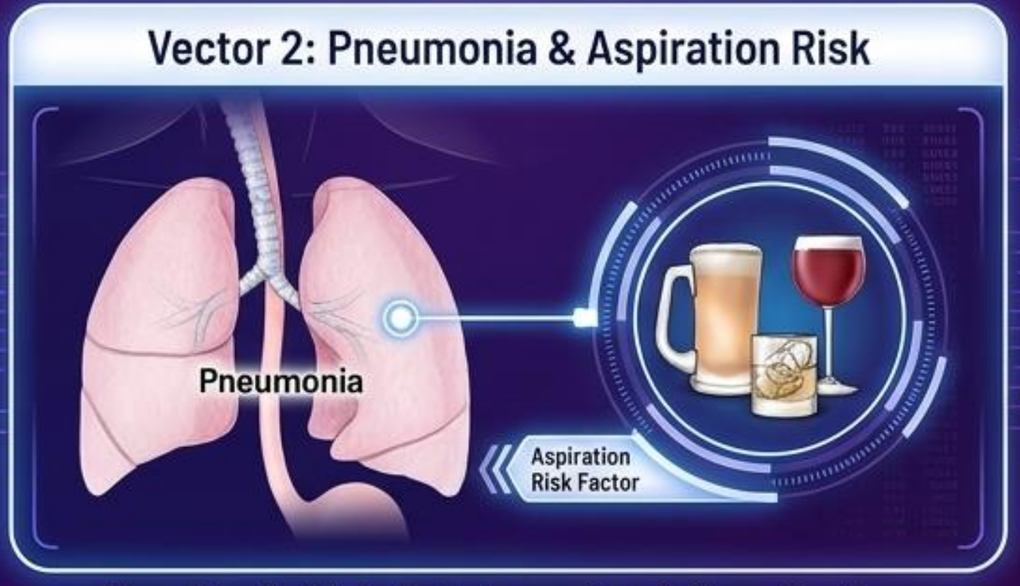
Patient Context & Exposure Risks

Vector 1: Strongyloidiasis Migration



Lifecycle & Pathogen Movement.

Vector 2: Pneumonia & Aspiration Risk



Algorithmic Link: Substance Use & Complications

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EtOH

↓

aspiration

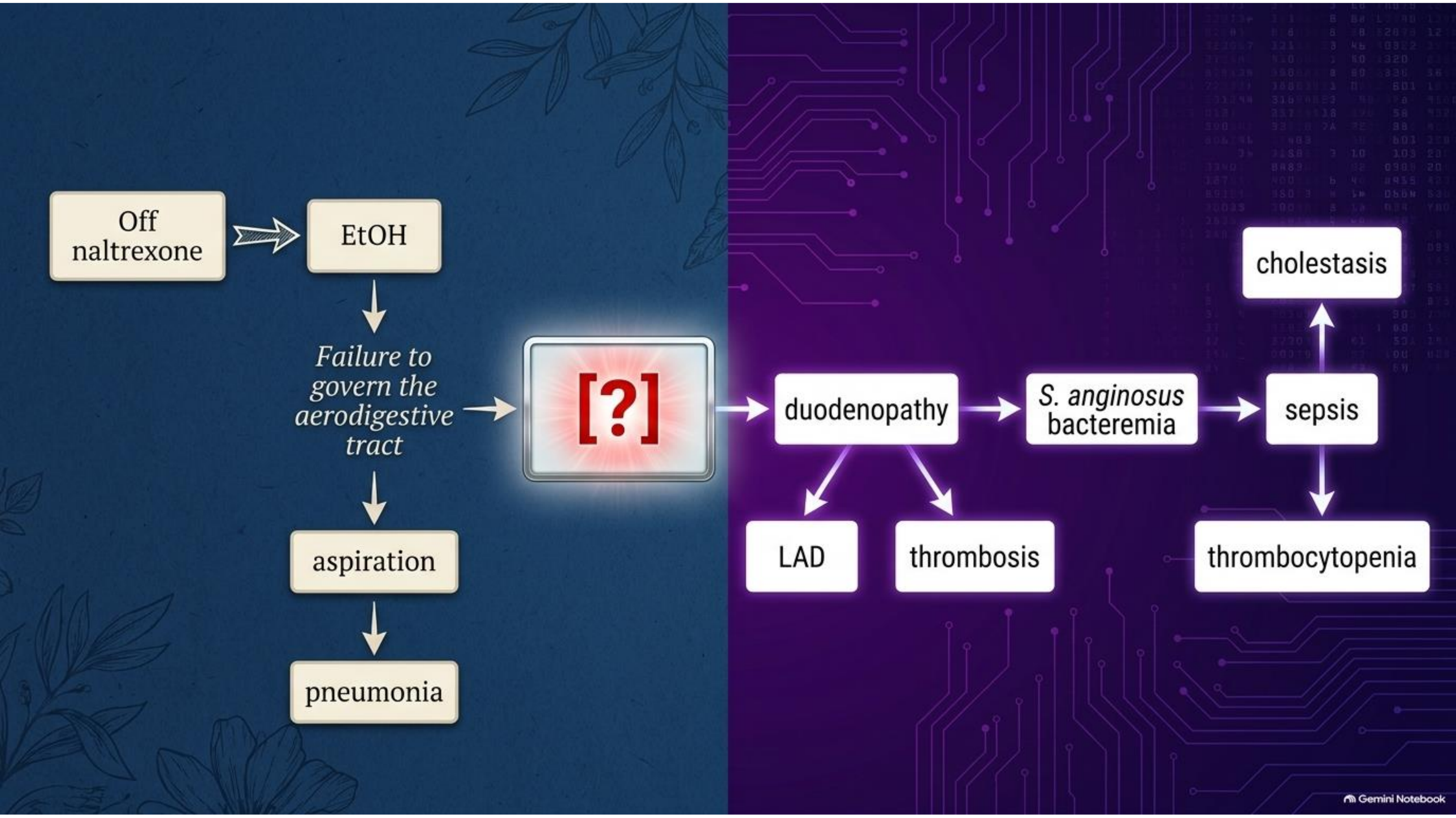
↓

pneumonia

PATIENT BEHAVIORAL LOGIC



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Off naltrexone
EtOH
Failure to govern the aerodigestive tract
aspiration
pneumonia
[?]
duodenopathy
LAD
thrombosis
S. anginosus bacteremia
sepsis
cholestasis
thrombocytopenia
Gemini Notebook

THE FINAL REVEAL



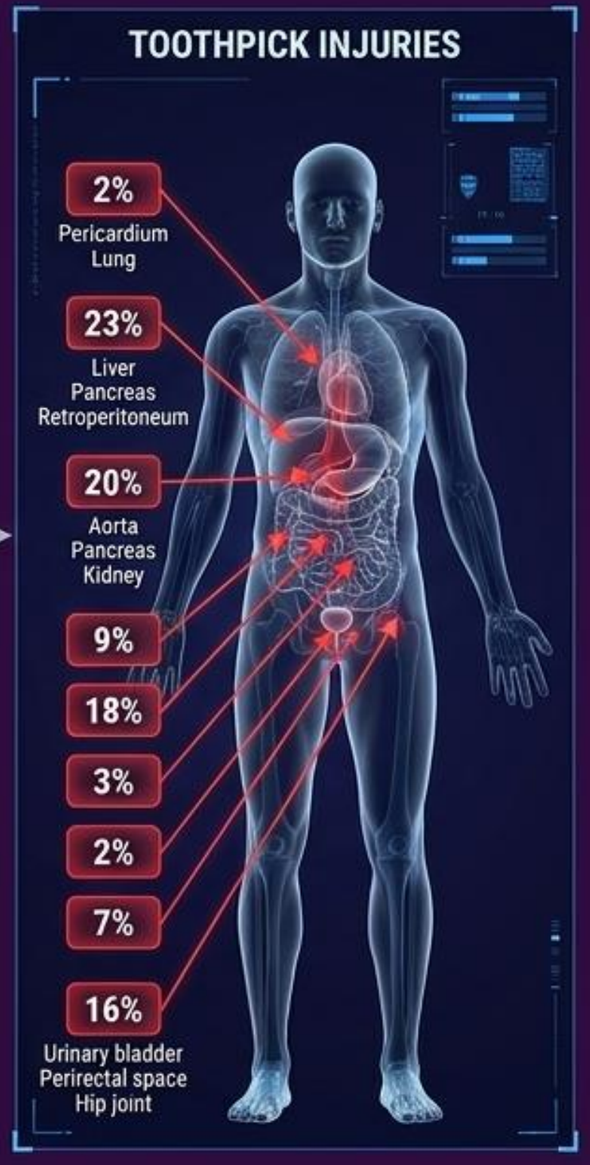
THE MECHANICAL CAUSE:
TOOTHPICK INGESTION



duodenopathy → duodenal-renal fistula/phlegmon → *S. anginosus* bacteremia → sepsis → cholestasis

sepsis → thrombocyt-openia

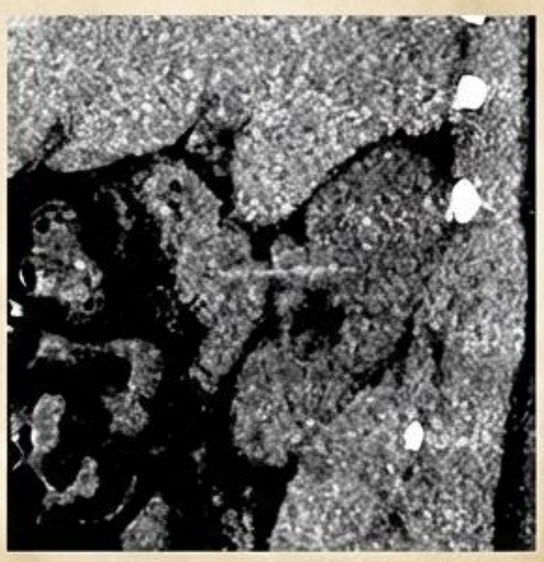
duodenopathy → LAD → thrombosis



Gemini Notebook

Hospital Day 3 — CT Angiography



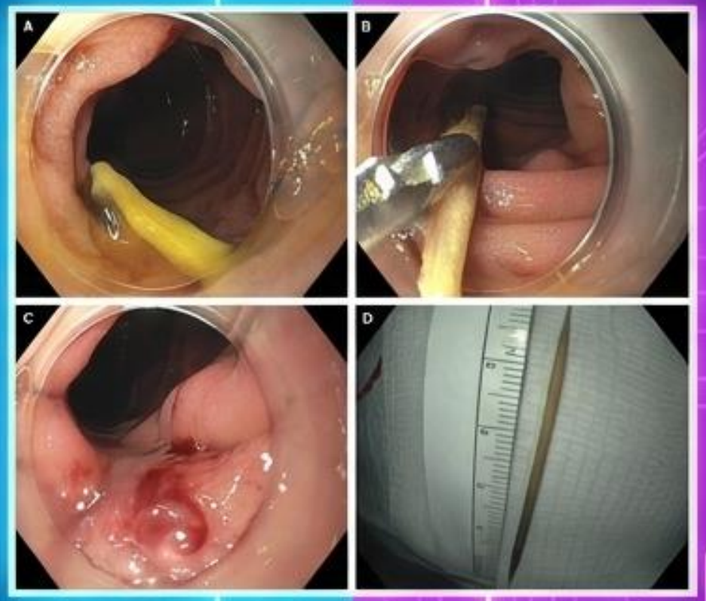


- Partial resolution of duodenal inflammation revealed a 5.2-cm linear hyperdense foreign body.
- The object penetrated the 2nd portion of the duodenum, traversed the anterior pararenal space, and entered the right renal hilum and upper pole.
- No active extravasation or vascular injury.

Gemini Notebook

The Intervention

- Multidisciplinary decision: Gastroenterology + Surgery + Radiology.
- Given the object's penetration into the kidney and proximity to vital structures → urgent intervention. EGD in the operating room under high bleeding-risk precautions.
- A foreign body corresponding to the CT finding was visualized in the 2nd portion of the duodenum. Removed intact using rat-tooth forceps. No bleeding during extraction or within 5–10 minutes afterward.
- The culprit: a 5.2-cm wooden toothpick. Patient remained stable → uneventful recovery.



Management & Outcome

- Polymicrobial bacteremia: *S. anginosus* + *Veillonella* → strongly suggested GI mucosal disruption. Concern for septic thrombophlebitis of renal vein/IVC.
- Rapid clinical improvement after toothpick extraction.
- Antibiotics: IV ceftriaxone × 3 weeks → PO amoxicillin × 3 weeks.
- Renal-vein thrombosis: Apixaban.
- Alcohol use disorder: Naltrexone + recovery support.
- 9-month follow-up: Clinically well, remained abstinent from alcohol.


Mankind
Won
The answer was
toothpick