mMEDCON International

Round _ MPSC: IMMUNOLOGY (90 points)

Case Study I: **Idiopathic AL Amyloid, 29 POINTS**

Patient Overview: A 60-year-old Margaret presented with increasing swelling of both legs over a period of 4 months. Ten years earlier, she had been treated for tuberculosis. On examination, she appeared pale with gross bilateral leg edema extending to the umbilicus, along with a large infected ulcer on the medial aspect of the right leg.

Investigations:

- Chest X-ray and ECG: Normal.
- Hemoglobin (Hb): 75g/L (microcytic anemia).
- Erythrocyte Sedimentation Rate (ESR): 140mm/h.
- Serum Albumin: 14g/L (low).
- Proteinuria: 12g/day (marked).
- Blood Urea, Serum Creatinine, and Creatinine Clearance: Normal.
- Serum Electrophoresis: No monoclonal band.
- Immunoglobulin Levels: IgG 2.2g/L (NR 7.2–19.0); IgA 1.2g/L (NR 0.8–5.0); IgM 1.2g/L (NR 0.5–2.0).
- Urine Electrophoresis: Showed albumin, gamma-globulin, and an M band in the β region.
- Serum and Urine Immunofixation: Presence of monoclonal free γ light chains in the urine only.

Questions

1. a) Based on the Serum and Urine Immunofixation tests, describe 2 other tests that may be conducted as a follow-up and why you would proceed with those tests. *(3 pts, 1 for tests, 2 for description)*

b)What indicators would be observed from the tests if the predicted condition is positive?

(1 pts, 0.5 for each test)

2. Some of the results of the test suggest that Margaret had multiple myeloma. Other than the absence of osteolytic lesions on the X-ray, list 2 other results that may exclude Multiple Myeloma as the final diagnosis. *(1 pts, 0.5 for each)*

3. What was the clinical significance of the bilateral leg swelling and its association with the condition identified above? *(2 pts, 1 for tests, 1 for description)*

4. The patient's history of tuberculosis was suspected to be a critical clue in identifying the final diagnosis. Explain why**.** *(2 pts)*

5. What role did the urine and serum electrophoresis play in arriving at the final diagnosis? *(2 pts)*

6. Why was Congo red staining performed, and what does green birefringence indicate based on the final diagnosis? *(3 pts, 2 for reason, 1 for the implication of green birefringement)*

7. What laboratory findings indicated nephrotic syndrome in this patient, and how is this related to the final diagnosis? *(3 pts, 2 for findings, 1 for description)*

8. How does light-chain-associated amyloidosis (AL amyloidosis) develop, and what is the role of monoclonal light chains? *(4 pts,2pts for each)*

9. Why is the absence of osteolytic lesions significant in ruling out multiple myeloma in this patient? *(2 pts)*

10. How did the lack of suppression of IgA and IgM levels help rule out multiple myeloma in this case? *(2 pts, 1 for reason, 1 for implication)*

11. Given the patient's stable renal function, she was managed with supportive care, including a low-salt, high-protein diet and diuretics. Why was the patient placed on a low-salt, high-protein diet, and what role did diuretics play in her treatment? *(4pts, 2 for reasons, 2 for role of diuretics)*

Case Study 2: Systemic Lupus Erythematosus (SLE), 32 PTS

Patient Info:

- Patient: Lisa- Female, 20 years old
- Living Situation: Resides in a small, rural town
- Initial Symptoms: Fatigue, anxiety, heart palpitations
- Medical History: Recently gave birth to her second child

Initial Symptoms and Medical Consultation:

In October, Lisa, a 20-year-old woman living in a small rural town, starts experiencing fatigue, anxiety, and heart palpitations shortly after giving birth to her second child. Her physician attributes these symptoms to postpartum stress and recommends rest. Despite her worsening symptoms, they gradually resolve after some time. Her family supports the physician's suggestion, attributing the symptoms to stress from motherhood.

Progression of Symptoms:

- Year 2: Lisa begins to experience unexplained abdominal pain. Her rural physician refers her to an internist in a larger city. The internist suspects gallbladder issues and recommends a low-fat diet and lifestyle changes.
- Year 5: Lisa becomes pregnant again. During her third pregnancy, she develops fatigue, headaches, leg swelling, and premature contractions in the sixth month. Bed rest is prescribed, and her family assists with childcare. She delivers a healthy child but continues to experience health issues.

Postpartum symptoms:

After giving birth to her third child, Lisa starts experiencing:

- Joint pain and swelling- Bilateral swelling and pain in her ankles, knees, elbows, wrists, and fingers.
- Cold intolerance- When exposed to cold, her hands and feet become painful, stiff, and discolored, indicating Raynaud's phenomenon.

Over-the-counter pain medications help temporarily, but she is still overwhelmed by her symptoms, which affect her ability to care for her family and work. Her physician remains puzzled and refers her to a rheumatologist.

Initial Rheumatological Consultation:

The rheumatologist orders several tests. Results reveal:

- ANA test: Positive (1:640)
- LE cell prep and Rheumatoid factor: Negative
- Sedimentation rate: Elevated at 62 mm/hr (normal for women: ≤ 20 mm/hr)

The rheumatologist suspects systemic lupus erythematosus (SLE) but hesitates to give a definitive diagnosis, fearing the psychological impact of labeling her with a chronic disease prematurely. He prescribes naproxen for inflammation and advises rest. Lisa feels frustrated, as her symptoms persist, and no one can give her a firm diagnosis. Fatigue, abdominal pain, joint pain, and cold intolerance continue to interfere with her daily life.

Skin Symptoms and Final Diagnosis:

In the summer of the following year, Lisa develops a strange red, raised rash on her face and arms after sun exposure (photosensitivity). Additionally, small, raised sores appear on her legs and arms. Convinced something is wrong, she consults another rheumatologist and shares her long medical history.

- Lab Results:
    - ANA: 1:640 (normal: No ANA detected in a titer with a dilution 1:32)
    - Anti-DNA antibody test: Elevated (normal: low or none)
    - Complement assay: Decreased C3 and C4 levels
    - Red blood cell count: 3.8 million/mm³ (normal: 4.2–5.4 million/mm³ for women)
    - Hemoglobin: 10.5 g/dL (normal: 12–16 g/dL for women)
    - Hematocrit: 35% (normal: 37% to 47% for women)
    - White blood cell count: 6,000/mm³ (normal: 5,000–10,000/mm³ for women)
    - Platelets: 138,000/mm³ (normal: 150,000–400,000/mm³)

The skin biopsy reveals small vessel vasculitis, and combined with the lab results, the rheumatologist concludes that Lisa meets the European League Against Rheumatism (EULAR) and American College of Rheumatology (ACR) criteria for an SLE diagnosis.

Final Diagnosis:

The physician explains that SLE is a chronic autoimmune disease where the immune system attacks its tissues, leading to widespread inflammation and tissue damage. The following criteria confirm Lisa's diagnosis:

- ANA titer >1:80 (entry criterion)
- Butterfly rash/facial erythema: 6 points (acute cutaneous lupus)
- Nonerosive arthritis: 6 points
- Hematologic disorder: 4 points (autoimmune hemolytic anemia)
- Immunologic disorder: 6 points (elevated anti-DNA antibodies)

With a total score of 22, far surpassing the 10-point threshold required for a lupus diagnosis, Lisa's diagnosis of systemic lupus erythematosus is confirmed.

Treatment and Patient's Response:

The rheumatologist prescribes a one-month course of prednisone (a corticosteroid) to reduce inflammation and instructs tapering the dose over time. Nabumetone (an anti-inflammatory) is added to her regimen before weaning off prednisone. The physician provides reassurance that SLE is manageable, although lifelong medical attention is required.

Lisa feels a mixture of emotions as she leaves the office;

- Relief: She now has a concrete diagnosis to explain her symptoms.
- Frustration: It took over seven years and multiple physicians to reach a diagnosis.
- Fear: She is uncertain about her future, knowing that lupus is a chronic and unpredictable disease.

Questions

1. Based on Lisa's initial symptoms (fatigue, anxiety, heart palpitations), what possible preliminary diagnoses could a physician consider(At least 2), and why might systemic lupus erythematosus (SLE) not initially come to mind(2 reasons)? *(4pts, 2 for reasons, 2 diagnoses)*

2. After Lisa developed abdominal pain two years later, why might the internist suspect gallbladder disease, and what further tests could be performed to rule out this preliminary diagnosis? *(4pts, 2 for reasons, 2 for tests)*

3. After Lisa experienced joint pain, swelling, and Raynaud's phenomenon, what autoimmune conditions should be considered, and why? What preliminary tests could help in differentiating between these conditions (describe)? *(6pts, 3 for conditions, 3 tests, all with descriptions)*

4. How did Lisa's pregnancy exacerbate her symptoms, and why might autoimmune diseases, like lupus, worsen during pregnancy? *(4pts, 2 for reason, 2 for the latter)*

5. Given Lisa's positive ANA test (1:640) and elevated ESR (62 mm/hr), what further diagnostic tests would be critical to narrow down her condition, and why? *(4pts)*

6. How could the butterfly rash and small raised sores that Lisa develops after sun exposure contribute to a lupus diagnosis, and what role does photosensitivity play in lupus?
(3pts)

7. What are the most common systemic manifestations of autoimmune diseases like systemic lupus erythematosus (SLE), and how do these conditions typically progress over time? (At least 2, *3pts)*

8. What are the long-term management strategies for systemic lupus erythematosus, and how can they improve patient outcomes? *At least 4, both Pharmacological and Lifestyle based*, *4pts, 2pts for each)*

Case Study 3: IL-12 Receptor Deficiency, 29 POINTS

A 5-year-old boy is brought to the emergency department with fever, rigors, hypotension, and dyspnea following BCG vaccine administration. During an IV attempt, he begins bleeding profusely from the site. A chest X-ray shows interstitial infiltrates, raising suspicion for pneumonitis. Blood specimens reveal the presence of acid-fast bacilli, and cultures are pending. Empiric treatment with fluoroquinolones is initiated.

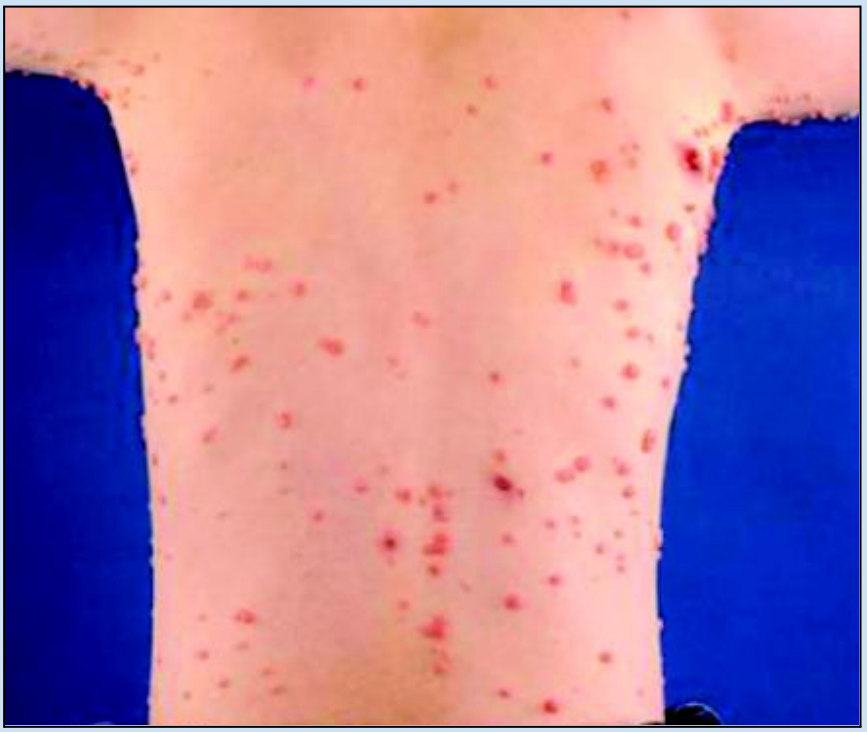

Figure 1; Bare chest with swellings.

Questions

1. Describe the significance of IL-12 in the immune system and how a deficiency in IL-12 receptor function affects this role. *(4pts)*

2. What is the genetic basis of IL-12 receptor deficiency and how does this inheritance pattern affect the likelihood of siblings being affected? *(2 pts)*

3. Given the patient's symptoms, what differential diagnoses should be considered, and what factors point specifically to IL-12 receptor deficiency? *(4pts, 2 for diagnoses, 2 for reasons)*

4. What laboratory tests would help confirm the diagnosis of IL-12 receptor deficiency and what findings are expected in this case? *(*At least 2, *3pts)*

5. What is the overall importance of the IL-12/IFN-γ pathway in defending against infections, and how might deficiencies in this pathway present clinically? *(4pts, 2 for diagnoses, 2 for reasons)*

A 6-year-old girl is brought to the emergency department with recurrent skin infections, fever, and a chronic cough. Her mother reports that the child has suffered from multiple bacterial skin abscesses over the past two years, often requiring antibiotics. She has also experienced recurrent oral thrush and Candida infections. Upon examination, the patient presents with several inflamed abscesses on her limbs and signs of bacterial pneumonia. A chest X-ray reveals bilateral patchy infiltrates. Blood cultures are pending, and empiric antibiotic treatment is initiated.

6. i) In another instance, a patient presented with recurrent bacterial infections, skin abscesses, and fungal infections, particularly chronic mucocutaneous candidiasis. Which interleukin is most likely deficient in this patient, and why? *(3pts)*

ii) Compare and contrast the clinical manifestations of IL-12 receptor deficiency with IL-X receptor deficiency(that you identified above) based on these two cases. *(4pts, 2 for comparisons for or against each case)*

While both conditions involve recurrent infections, the infections in IL-17 receptor deficiency tend to be localized to the skin and mucosal surfaces, whereas IL-12 receptor deficiency typically leads to systemic, disseminated infections.

iii) What tests would help differentiate between the deficiency diseases in patients with recurrent infections? *(4pts, 2 each disease)*

7. ***Bonus (1pt)*** I have completed all the questions

- ☐ Yes
- ☐ No