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BIOL 302 Lab

Section 4

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Section 4 DIAGNOSIS ASSIGNMENT

A patient came in presenting with symptoms of chronic, productive cough with blood in the sputum, fatigue and night sweats, and pulmonary function tests and complete blood count were run. For the pulmonary function test, it was found that his vital capacity (VC) was severely decreased, the functional residual capacity (FRC) was slightly below normal, and the total lung capacity (TLC) was markedly decreased. The maximum inspiratory and expiratory flow rates were normal. The complete blood count revealed that he had normal erythrocytes and hemoglobin counts, but a high leukocyte count. He also had a slightly high count for polymorphonuclear neutrophils. This all indicated that the patient had a restrictive lung disorder, which was seen by the decreased VC and decreased TLC, whereas if it were obstructive disorder the VC would be normal or decrease with the TLC being normal or increased. His results also indicated that he had an infection which could be seen by the increased leukocyte count. The next issue was figuring out which restrictive lung disease was causing the patients symptoms.

The major clue that helped to discover what disease this was, was that the patient disclosed that he had a lifelong habit of consuming milk direct from the cow. This allowed us to make the easy conclusion that this patient had bovine tuberculosis (bovine TB) caused by the bacterium *Mycobacterium bovis*. The common symptoms of bovine TB are fever, night sweats, persistent cough, diarrhea, weight loss, and abdominal pain, and seeing as the patient presented with three of the symptoms it is believed that the patient has bovine TB. To test for this disease, we would take radiographs of the chest, an AFB smear and culture, and the administer an interferon-gamma release assay (IGRA), a blood tests for TB infection. We would not do a tuberculin skin test because it is recommended to not do the test on a patient who is presenting with symptoms of the disease due to possible co-infection and worsening of disease. The IGRA is run one of two ways. Both begin with drawing blood from the patient, from there it goes through one of two processes. One is the QuantiFERON-TB Gold In-Tube test (QFT-GIT), where within 16 hours the blood is processed, then is mixed with a mixture of synthetic peptide that represent ESAT-6 (a secretory antigenic target produced by the bacterium), CFP-10 (a secretory antigen from the bacterium), and TB7.7 (an antigen). These stimulate the cells in the blood to release interferon-γ (IFN- γ), which is then detected by enzyme-linked immunosorbent assay (ELISA). The presence of IFN-γ indicates if the bacilli are present or not. The other process is T-SPOT TB test (T-spot). This test processes the peripheral blood mononuclear cells (PBMCs) within 8 hours and then mixed with ESAT-6 in one test tube, and CFP-10 in another, and then the mixtures are tested to measure the number of IFN-γ producing cells. The presence

of these cells indicates the presence of the bacterium.

But what exactly is bovine TB? Well as stated before, bovine TB is caused by the bacterium *Mycobacterium bovis*, which is an aerobic bacterium that grow slowly. This bacterium is most often seen in cattle, bison, deer, and elk, but can be transmitted to people by close contact with the animals, transmitted by the air breathed by the animals, handling the animal meat and products, or drinking unpasteurized milk. The last method mentioned is what made the patients mention of drinking milk straight from the cow so important and helpful in diagnosing him. *Mycobacterium bovis* usually spread by aerosols, which lead to infection of lungs. The newly introduced bacilli induce a rapid acute inflammation response with infiltration of neutrophils. This then leads to accumulation of macrophages that ingest the bacilli and neutrophils. When ingested most bacilli are killed or deactivated, some, however, can do one of two things. They can cause the macrophage to transform into epithelial cells that form nodules, or tubercles, or it can survive and multiply and spread when the cell dies. These new bacteria can then spread by the lymphatic system and/or bloodstream to infect tissues and organs. Back in the lungs, where the macrophage has been transformed into epithelial cells, the new tissue can remain the same for two weeks and then the nodules begin to degenerate to from dry, firm, coagulated masses called granuloma. This is what leads to the restrictive lung disease that we see in this patient.

The next step in this process of taking care of this patient is to treat. Bovine TB is treated the Usually TB is treated with a mixture of several antibiotics, which are Isoniazid, Rifampin, Ethambutol, and Pyrazinamide (which isn't used in this case). If the disease is from a drug-resistant strain, then may need to use a combination of fluoroquinolones, which are antibiotics, and injectable medications. The injectable medications could be amikacin, kanamycin, or capreomycin. There are some possible side effects to these drugs, but they are very rare. This treatment can take anywhere from 6 months to 20 or 30 months, depending on if the strain is drug-resistant or not.

Bovine Tuberculosis is rare in developed countries due to the fact that most milk is pasteurized, and this is what makes this patients situation a bit odd. Ultimately, it is a good thing that this patient came in, because left untreated, Tuberculosis disease will only get worse and could possibly lead to death.

Bibliography

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