Case Study: Myasthenia Gravis

Myasthenia gravis is a chronic, progressive autoimmune disease in which the body's own immune system attacks and destroys acetylcholine receptors at skeletal muscle neuromuscular junctions. In patients with myasthenia gravis, acetylcholine is released from motor neurons normally, but there are few remaining receptors in skeletal muscle sarcolemmas to receive it, so acetylcholinesterase breaks much of it down before it ever binds a receptor. Myasthenia gravis usually does not affect smooth muscle acetylcholine receptors.

Chief Complaint: A 26 year-old woman with muscle weakness in the face.

History: Jill Rothman, a 26 year-old gymnastics instructor, presents with complaints of muscle weakness in her face that comes and goes, but has been getting worse over the past two months. Most notably, she complains that her "jaw gets tired" as she chews and that swallowing has become difficult. She also notes diplopia ("double vision") which seems to come on late in the evening, particularly after reading for a few minutes. At work, it has become increasingly difficult to "spot" her gymnasts during acrobatic moves because of upper arm weakness.

On physical examination, she has notable ptosis ("drooping") of both eyelids after repeated blinking exercises. When smiling, she appears to be snarling. Electromyographic testing revealed progressive weakness and decreased amplitude of contraction of the distal arm muscles upon repeated mild shocks (5 shocks per second) of the ulnar and median nerves. (These nerves stimulate the flexor muscles of the hand and fingers.) Both her symptoms and electromyographic findings were reversed within 40 seconds of intravenous administration of endrophonium (Tensilon), an acetylcholinesterase inhibitor (i.e. an "anticholinesterase"). Blood testing revealed high levels of an anti-acetylcholine receptor antibody in her plasma, and a diagnosis of myasthenia gravis was made.

1. Explain how Jill’s myasthenia gravis caused her muscle weakness.

2. How are the anti-acetylcholine receptor antibodies interfering with her normal skeletal muscle activity?

3. Explain why anticholinesterase drugs reverse Jill’s symptoms.
Jill was treated with pyridostigmine bromide, which is a long-acting anticholinesterase drug, and was also started on prednisone, which is a corticosteroid drug. (Corticosteroid drugs act to suppress the immune system and may promote the formation of new acetylcholine receptors in muscle cell membranes.) She also underwent occasional plasmapheresis when her symptoms became especially severe. (Plasmapheresis is a procedure in which the blood is filtered to remove acetylcholine receptor antibodies.) She was given a prescription of atropine as needed to reduce the nausea, abdominal cramps, diarrhea and excessive salivation she experienced as side effects of the anticholinesterase drug. (Atropine acts by blocking smooth muscle acetylcholine receptors.)

4. Explain why the pyridostigmine bromide caused Jill's side effects, especially abdominal cramps.

5. Why is atropine beneficial in treating the side effects mentioned above?

6. How does the corticosteroid medicine Prednisone benefit Jill?

7. Why must Jill undergo plasmapheresis when her symptoms become especially severe?

8. Why are the beneficial effects of plasmapheresis only temporary?

9. Jill’s doctor advises her that she is at increased risk for respiratory failure. Explain why this is so.