

The case of the terrible tooth essay sample



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1. List the symptoms experienced by Mr. Gower.

Mr. Gower experiences symptoms such as feeling hot, and light headedness, and unawareness. He felt hot and warm prior to the root canal removal. Therefore this symptom is most likely hinting at some problems he got before the removal. His symptoms of lightheadedness could be due to the effects of the surgery or anesthetic. Need more information to be sure.

2. Novocain blocks action potential production at the site of injection. How do you think Novocain works on the axon membrane, and how does it block the sensation of pain? Novocain serves to block receptors on nerve cells that sense pain. Therefore preventing neurotransmitter from binding to the receptors and stimulating sensory neurons to fire. More specifically Novocain blocks the sodium channel and prevents depolarization from occurring in the neurons of the site of injection. Because of this an action potential is not possible and neurotransmitter cannot be release.

Questions

3. What new symptoms does Mr. Gower exhibit?

Mr. Gower now experience a stiff jaw with extreme mouth pain, a lower than normal blood pressure of 100 over 60, weakness, and muscle fatigue.

4. Which of these symptoms could be due to the previous day's procedure?

The stiff jaw and extreme mouth pain could most likely be due to the previous day operation. This is because the mouth was operated on and the after effects of a root canal removal is starting to kick in. However the lowered blood pressure, muscle weakness, and fatigue could be due to an initial problem before the root canal.

5. Why can't Mr. Gower open his mouth?

Mr. Gower cannot open his mouth because his jaw is in a lock state. This is most likely caused by abnormally high frequency of excitatory postsynaptic potential or EPSP in his jaw muscles. This will cause involuntary contraction of those muscle essentially locking up his jaw.

6. What are the possible diagnoses for Mr. Gower's condition at this time?

For each diagnosis that you come up with, describe the symptoms that relate to that diagnosis One possible diagnosis is that Mr. Gower has temporal mandibular disorder. The symptoms for this includes pain in jaw area, lock jaw, and feeling fatigue or dizzy. Another possible diagnosis is the Mr. Gower has Tetanus disease. The symptoms for this includes involuntary muscle contraction in area of infection, restlessness, lock jaw, and difficulties breathing.

Questions

7. What new symptoms does Mr. Gower exhibit?

Mr. Gower now experiences sweating from a fever, rigid neck, dry mouth, and locked lips. These symptoms are closer associated with Tetanus disease.

8. Is there a common factor between his jaw being locked shut, his rigid

neck, and his lips being drawn across his mouth in a constant grin? The common factor is that all these symptoms occurs near his mouth area.

Inferring from this and his fever it is very possible there is a Tetanus infection near his mouth area possibly from the root canal removal. This infection is currently spreading and inflammatory responses are causing his fever.

9. Look at the diagram of three nerve cells on the right. At the bottom, there is a postsynaptic cell, which receives chemical synapses from two presynaptic cells, which are shown at the top of the diagram. One of the presynaptic cells is labeled excitatory and the other is labeled inhibitory. Assume that a single action potential in a presynaptic cell does not produce an action potential in the postsynaptic cell. Show (by drawing a graph of membrane potential against time) how the membrane potential of the postsynaptic cell changes if there is one action potential in: a. Only the excitatory presynaptic cell.

On back of case study

b. Only the inhibitory presynaptic cell.

On back of case study

c. Both the inhibitory and the excitatory presynaptic cells. On back of case study

10. Now think about how the two presynaptic cells could produce an action potential in the postsynaptic cell. a. Which presynaptic cell must have action potentials to produce one or more action potentials in the postsynaptic cell? Excitatory presynaptic cell must have action potentials to produce one or more action potentials in the postsynaptic cell because they promote depolarization of membrane which is needed to cause an action potential. On the other hand Inhibitory presynaptic cell promote hyperpolarization which goes against producing an action potential. b. What phenomena must take place for the small postsynaptic potentials to reach threshold and produce action potentials? Summation of Excitatory postsynaptic potential and Inhibitory postsynaptic potential must take place. More specifically spatial

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summation, which means that all the types of potential must add up to be greater (less negative) than the threshold potential of -55mv for an action potential to occur in the postsynaptic neuron.

c. If the frequency of action potentials in this presynaptic cell (#10a) increases, what happens to the number of action potentials in the postsynaptic cell? If the frequency of action potentials in the excitatory presynaptic cell increases then the number of action potentials in the postsynaptic cell will increase as well. This is due to temporal summation of EPSP at very frequent times. This causes the postsynaptic cell to produce many action potential in succession. d. What happens to the number of action potentials in the postsynaptic cell if the other presynaptic cell (#10a) also produces action potentials? If the frequency of action potentials in the inhibitory presynaptic cell increases then the number of action potentials in the postsynaptic cell will decrease. This is due to spatial summation of both EPSP and IPSP. Mostly it is because IPSP promote hyperpolarization which will make it a lot harder to depolarize the membrane to be greater (less negative) than the threshold potential, and making action potential less possible.

11. Assume that the postsynaptic cell in the diagram is a motor neuron. If Mr. Gower's problems are associated with maintained muscle contraction, what must take place in the motor neuron to produce a maintained muscle contraction? The inhibitory synaptic cell must have more action potential that can affect the postsynaptic cell to create more IPSP to lessen the muscle contraction. With a higher number of EPSP than IPSP, Mr. Gower experiences an irregular amount of contraction of the motor neurons

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because action potentials are frequently fire off. IPSP is needed to tone down or relax the muscle by lessening the action potentials created in postsynaptic cell. His involuntary contractions are the cause of his locked jaw, stiff lips, and rigid neck.

12. Assume that both presynaptic neurons have action potentials. What two conditions in these presynaptic cells would produce an increase in the number of action potentials in the postsynaptic (motor) neuron? A greater frequency of action potential in the excitatory presynaptic cell and a lesser frequency of action potential in the inhibitory presynaptic cell would produce an increase number of action potential in the postsynaptic neuron. These two conditions are currently happening to Mr. Gower's neurons around his mouth area.

13. Do you wish to change or modify your diagnosis of Mr. Gower's problem? I believe that Mr. Gower is facing a Tetanus infection near his mouth. This is because the rigid neck, and stiff lips suggests that he is experiencing abnormal muscle contraction in that area. Therefore an infection in this area that is slowly growing can only be responsible for this. It is also very possible he contracted this infection during his root canal operation. In addition, it is more logical than Mr. Grower suddenly having temporal mandibular disease.

The Emergency Room

Questions

14. What is the normal response to someone placing a tongue depressor on the back of your throat? The normal response to someone placing a tongue depressor on the back of your throat would be that they regurgitate or gag

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because of gag reflexes which something is forced down our throat. 15. Why didn't Mr. Gower open his mouth with the tongue depressor test? Mr. Gower could not open his mouth because his jaws are locked up due to the muscles around his neck and jaw area contracting too much. 16. What does this tell you about the action potential activity in Mr. Gower's motor neurons to his jaw (and neck) muscles?

This tells me that there is a very high activity or frequency of action potentials in Mr. Gower's motor neurons in his jaw and neck muscles. Specifically, his body is either sending extremely high level of EPSP or something is inhibiting IPSP from reaching his motor neurons. 17. Go back to your answer to Question 12 in the last part of the case. Do the results of the tongue depressor test support one of the two answers? Yes it does support one of the answer. The answer it support is that there seem to be a lesser frequency of IPSP or action potential in the inhibitory presynaptic cell. Mr. Gower seems to be experiencing a Tetanus infection that is preventing IPSP from reaching his motor neurons around his mouth area. 18. What does the antibody titer tell the physician?

The antibody titer essentially tells the physician how much antibody is produced in Mr. Gower's mouth area by taking a blood sample. This is for Dr. Umphsea to test how strong Mr. Gower's immune system is as well as test her initial suspicion that Mr. Gower has not taken his Tetanus shot. He does this to make sure that his diagnosis is correct. 19. Does this explain his fever?

Yes, this does explain his fever. This is because if Mr. Gower has a Tetanus bacterial infection than that means that his body is sending a lot of aid to combat the infection causing an inflammation in his mouth area. Naturally his body heats up to try to kill off the bacteria and therefore cause his fever.

20. Why is penicillin prescribed for Mr. Gower's condition? Penicillin is prescribed for Mr. Gower's condition because it is an antibiotics that can destroy the bacterial growth that is currently taking place in his mouth. This will hopefully lessen or solve his current symptoms. In addition, Dr. Umphsea mentioned culturing the wound in his mouth to see the current state of the bacterial growth from the infection. 21. How did Mr. Gower initially become infected?

Mr. Gower most likely become infected after his root canal removal. The initial mulch exposure into the surgery was the reason why the bacteria come to find its way into his mouth. That along with the removal of his root canal which exposes a vulnerable spot for the bacteria to attack shed light into how he became infected. 22. Do you wish to change or modify your diagnosis of Mr. Gower's problem? My current diagnosis is that Mr. Gower became infected with the Tetanus bacteria after undergoing his root canal removal. The tetanus bacteria was introduced into the surgery when mulch came flying in through the window. Finally the growth and development of the Tetanus bacteria is what caused stiffness and pain in his mouth area as well as his fever.

End of the Day

Questions

An action potential in a motor neuron produces a contraction of the muscle fibers it supplies. Tetanus toxin is thought to decrease inhibitory synaptic effectiveness, especially onto the motor neurons to the face and neck. As a result, the motor neurons produce more action potentials than usual and the muscles remain contracted over a long time period. One effect of tetanus infection is called lockjaw.

23. Fill in the flow diagram (see next page) for inhibitory chemical transmission. On back of Case study.

24. Look at each stage in the diagram and suggest how tetanus toxin could decrease the postsynaptic response, i. e., the response of the motor neuron. The Tetanus toxin produced by the bacteria attack the inhibitory neurotransmitter GABA pathway. Thereby, decreasing the amounts of IPSP signals to reach the motor neuron in Mr. Gower's mouth area and this causes over contraction of the muscles in that area because of higher amounts of EPSP. More specifically the toxin stops the release of GABA by targeting the synaptobrevin protein in the pathway. Synaptobrevin is responsible for stabilizing snare proteins and without snare proteins hooking SNAP25 and Synapsin together it is not possible for the neurotransmitter GABA to be release from the presynaptic membrane.

25. Think about the release of synaptic transmitter and its reaction with the postsynaptic receptor to open a channel. How could benzodiazepines, like diazepam, work to counteract the effect of tetanus toxin? Benzodiazepines, like diazepam, work to counteract the effect of Tetanus toxin by increasing

the efficiency of GABA transmitter. GABA is an inhibitory neurotransmitter and therefore is needed to tone down the contraction of the muscles in Mr. Gower's mouth. However, the tetanus toxin decreases the amounts of GABA release from presynaptic membrane. Diazepam binds to GABA receptors and causes an immediate increase in chloride ions of post-synaptic neuron which hyperpolarize the neuron and therefore makes it less excitable despite having a greater amount of EPSP than IPSP. This in turn, tone down the contractions in the motor neurons of Mr. Gower's mouth counteracting the effects of the toxin.

26. What characteristic does Mr. Gower possess that would make him be more susceptible to the tetanus toxin? Some characteristics that made Mr. Gower more susceptible to the tetanus toxin are that he did not get a Tetanus vaccine, he has a weaker immune system because he is old, and that he happens to be in the same room as the bacteria when he undergo the root canal removal.