

Malaria: causes, prevention and treatments



Introduction

There are over 100 species of malaria parasites the most known to cause death is in Africa called plasmodium falciparum (Malaria No More 2014). Only female anopheles mosquitos can transmit malaria (Malaria No More 2014). The malaria parasite is a member of the apicomplexa they are characterized by a set of organelles (Greenwood et al., 2008). These organelles are known as apical organelles because are located at the end of the parasite (Greenwood et al., 2008). This plasmodium parasite has cycles to develop in the mosquito (Greenwood et al., 2008). When this parasite enters the body through the mosquito it invades the liver there it multiplies 10, 000 times two weeks in, the parasite goes into the blood stream where it infects the red blood cells (Malaria No More 2014).

Currently 1 million people are dying from malaria and 500 million cases (Greenwood et al., 2008). As of now 2 billion are at risk of malaria mostly affecting poor populations around subtropical and tropical areas because the temperature and rain are better for the development of the malaria causing parasites in mosquitos (Greenwood et al., 2008). Malaria is a mosquito borne disease caused by a parasite (Centers for Disease Control and Prevention, 2014). It usually causes chills, muscle pain, fever, and flu like illness (Malaria. com, 2011). It can also cause severe problems such as damage to the brain, heart, kidneys, and lungs (Malaria. com, 2011). When malaria is untreated it develops severe complications and causes death (Malaria. com, 2011). Malaria is caused when a mosquito infected with parasites bites a person (Malaria. com, 2011). In some rare occasions people can get it when they come in contact with infected blood (Malaria. com, 2011).

Review and Results of Case Study

In this study a 46 year old male was admitted to a hospital in Saudi Arabia (Hussain et al., 2008). 10 days before he was admitted had many symptoms which included abdominal pain, vomiting, and loose stools. He also got bloody diarrhea a day before his admission (Hussain et al., 2008). He didn't appear to have a fever or cold and flushing of face and his medical history was great (Hussain et al., 2008). Once he was admitted he had a report of his blood film which was negative for malaria parasites (Hussain et al., 2008). His examination showed that he had diffuse congested mucosa of the stomach (Hussain et al., 2008). His blood, urine, and stool culture reports were all negative (Hussain et al., 2008).

They did find hematological findings which were anaemia with hemoglobin because of the destruction of the red blood cells (Hussain et al., 2008). He had a slightly impaired renal function but his liver function tests were normal. 5 days after his admission on a routine peripheral smear they reported a sexual form of plasmodium malariae (Hussain et al., 2008). They didn't know if he had malaria because he had no signs of organ damage and didn't fulfill the World Health Organization criteria of severe malaria (Hussain et al., 2008). The patient had recent history of travel to Pakistan without taking chemoprophylaxis for malaria since malaria is widely distributed in Pakistan (Hussain et al., 2008). This patient was given drugs and blood to correct anaemia from malaria and gastrointestinal bleeding (Hussain et al., 2008). He was later released four weeks later (Hussain et al., 2008).

Analysis

Malaria is a parasite called plasmodium malariae which starts of in the mosquito (Collins & Jeffery, 2007). The mosquito has a small number of sporozoites that go to the salivary duct it is then injected to the venules of the bitten human (Collins & Jeffery, 2007). When the parasite enters the blood stream, within an hour the sporozoites attack's the liver (Collins & Jeffery, 2007). Once inside a parenchymal cell the parasite matures in 15 days (Collins & Jeffery, 2007). Within this time period thousands of merozoites are produced. These merozoites invade the red blood cells and start the erythrocytic cycle (Collins & Jeffery, 2007). After a developmental cycle happens in the red blood cells, for a couple of days some merozoites are released and reinvade more red blood cells (Collins & Jeffery, 2007).

While the malaria parasite is multiplying in the red blood cells it has to be moving between cells otherwise it will get cleared out by the immune system (Harvard School of Public Health, 2012). In the parasites nucleus there is a gene called virulence which encodes a protein on the surface of the parasite to allow it to enter the blood cells where it can turn off and on to hide (Harvard School of Public Health, 2012). It is able to turn off the gene by packing the gene up into a tight ball in the nucleus to turn back on it simply unpacks itself from the ball (Harvard School of Public Health, 2012).

The parasite forms a protein which binds to a specific antigen called Duffy antigen (GenePlanaet, 2012). This antigen is common in our blood cells this makes a Duffy antigen system which is like the AB0 blood system (GenePlanaet, 2012). People with Duffy positive have these antigens Duffy negative doesn't (GenePlanaet, 2012). The malaria parasite needs these Duffy proteins to enter the blood stream and develop the infection

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(GenePlanaet, 2012). People with Duffy negative are resistant to malaria because they don't have this antigen (GenePlanaet, 2012).

Symptoms and Tests

There is uncomplicated which last 6-10 hours which has a cold stage a hot stage and a sweating stage (Centers for Disease Control and Prevention, 2014). In a cold stage the person has a sensation of a cold and shivers (Centers for Disease Control and Prevention, 2014). The hot stage consists of fever, headaches, vomiting, and seizures in young children (Centers for Disease Control and Prevention, 2014). The sweating stage is when the person sweats and returns to a normal temperature and experience tiredness (Centers for Disease Control and Prevention, 2014). Some symptoms of this are fever, chills, sweat, headache, nausea and vomiting, body aches, and general malaise (Centers for Disease Control and Prevention, 2014). Some physical symptoms may include increased respiratory rate, weakness, elevated temperature, enlarged spleen, enlarged liver and perspiration (Centers for Disease Control and Prevention, 2014). Sever malaria has different results a person might have seizures go into a coma or other neurologic abnormalities (Centers for Disease Control and Prevention, 2014). They can also experience server anemia because of the destruction of their red blood cells. Acute respiratory distress, abnormalities in the blood, low blood pressure, kidney failure, and metabolic acidosis are other results of server malaria (Centers for Disease Control and Prevention, 2014).

Tests that were given in this case study were blood smears, endoscopic examination, and abdominal ultrasound. Blood smears are taken from a finger prick (webmed, 2011). When the doctors do blood smear tests they use thick and thin blood smears to know if someone has malaria (webmed, 2011). It will let them know the percentage of red blood cells that are infected with the parasite (webmed, 2011). When they do a thick blood smear a drop of blood is put on a glass slide for examination (webmed, 2011). These tests are more useful to determine the presence of the parasite because they use a larger sample of blood to examine (webmed, 2011). A thin blood smear is a drop of blood that is spread across the slide this helps them know what type of malaria the patient has (webmed, 2011). In this case the blood film came back negative for malaria parasites (Hussain et al., 2008). They performed an endoscopic exam in which they found a diffuse congested mucosa (Hussain et al., 2008). They also did an abdominal ultrasound which came out normal (Hussain et al., 2008).

There are other ways to test for malaria for example there are various test kits to detect antigens from malaria parasites these kits are usually used where microscopic diagnosis is not available (Centers for Disease Control and Prevention, 2012). There is also a molecular diagnosis where the parasite nucleic acids are detected through a reaction using polymerase chain (Centers for Disease Control and Prevention, 2012). They can also do a serology test that detects antibodies against malaria parasites (Centers for Disease Control and Prevention, 2012). This test uses indirect immunofluorescence or enzyme linked immunosorbent (Centers for Disease Control and Prevention, 2012). This test does not detect the current infection

what it detects is the past exposure (Centers for Disease Control and Prevention, 2012). There are lateral strip tests what these tests allow them to do is to target histidine rich protein 2 of the malaria parasite and its specific lactate dehydrogenase (Kakkilaya, 2011). These don't require any type of machinery so they can be performed anywhere (Kakkilaya, 2011). The kidney and liver are checked to see if they have any damage to see if they have malaria or rule it out.

Treatments

There are several treatments and that are given to stop the malaria parasite from developing in the blood. Some of them are chloroquine, malaron, lariam, quinine, doxycycline, clindamycin, and quinidine (Centers for Disease Control and Prevention, 2012). Chloroquine helps prevent the malaria parasite to develop in the blood (WebMed, 2014). Chloroquine stops the parasite by blocking the chemical that protects the parasite from haem which is toxic to it (NetDoctor, 2013). This drug is taken orally and it is taken weekly for 4 weeks (NetDoctor, 2013). Malarone stops the parasite from reproducing by blocking an enzyme called dihydrofolate reductase which helps reproduce (NetDoctor, 2013). The dihydrofolate reductase enzyme makes folinic acid from folic acid and this is essential for the parasite to make a new DNA which is needed to reproduce (NetDoctor, 2013).

Lariam kills the malaria parasite but it is not understood how it does this (NetDoctor, 2013). This drug is useful for travellers to areas where it is known to be (NetDoctor, 2013). Quinine is used to treat malarial infections it attacks the parasite once it enters the red blood cells and stops it from

multiplying (NetDoctor, 2013). Doxycycline is an antibiotic that stops the parasite (NetDoctor, 2013). It stops it from producing proteins that are needed to stay alive and multiply once it stops it then it is killed by the immune system (NetDoctor, 2013). Quinidine is used for severe cases of malaria it is directly given into a vein for 7 days in a hospital because the person's heart needs to be monitored (NetDoctor, 2013).

In this case the patient was given quinine infusion for 48 hours after the 48 hours he was given 600 mg of quinine orally (Hussain et al., 2008). He was also given some supportive drugs orally for a week which consisted of 500 mg of doxycycline, 40 mg of pantoprazole, and 200 mg of ferrous fumarate for 7 days (Hussain et al., 2008). He was also given two pints of blood. Four weeks after these drugs were given to him he was discharged from the hospital with a negative blood film for malaria and he did not have any symptoms since his arrival to the clinic (Hussain et al., 2008). He was asked to come back to do further tests to be assured the malaria parasite was gone but he did not return to the clinic (Hussain et al., 2008).

Conclusion

Malaria can be prevented and if infected it can be treated. It is caused by a parasite that only female mosquitoes can carry. When these mosquitoes go and take blood meals they transmit the human it bites. The parasite makes its way to the liver by masking itself from the body so it won't detect it and eliminate it where later it makes its way to the blood stream and attacks the red blood cells. As of now there are many cases of malaria mostly in the African regions. Although there are treatments for malaria there are still a lot

of people who die from it. Children and pregnant women have a higher risk of dying of malaria.

Malaria can also be confused with other diseases because the symptoms are similar. This parasite is a very sneaky which likes to hide and wait for a period of time to multiply and prepare to attack the body. Although this might be the case there are plenty of tests given to find out if someone has malaria to stop it before it can really do some serious damage to the liver. There are some good drugs to help eliminate this parasite from our bodies. Sometimes people might think that this parasite is gone some people that have recovered from the first episode of this illness there might be several attacks called relapses this could happen within a month or even years of having no symptoms. This usually occurs because they have stage parasites in the liver that reactivate. There are treatments given to reduce the chances of having these relapses. This can be a dangerous disease if not treated on time, but it can be prevented by tests to diagnose it before it is too late.