Malaria: causes and effects

A parasite lives with another organism, its host, and causes it harm due to the close relationship it encompasses with the host. Some parasitic relationships are harmless, while in other cases a parasite can damage or even kill its host. The parasite is reliant on its host for its life behaviour and functions, also to stay alive. For example, viruses are common parasites. The parasite has to be in its host to live, grow, contain shelter, and multiply. In this article, the Plasmodium Parasite will be explored and scrutinized. Some questions that will be answered are; what does this Parasite cause to the human body? Who or what is responsible for this illness? How the parasite operates and behaves? And how have humans acted upon improving the status of this illness? The Plasmodium parasite causes a very harmful but curable disease. This is well-known as ‘ malaria’. This disease will also be discussed variously throughout this article. (Encyclopedia, 2008)

Malaria can cause several different effects on the human body. Being a serious and infectious disease spread by certain mosquitoes, it can be characterized by recurrent symptoms of chills, fever, and an enlarged spleen. It is most common in tropical climates (e. g. Africa, South America, Asia etc.) This disease is treatable with medication, but it often recurs due to it being endemic (occurs frequently in a particular locality) in many third world countries. (Malaria)

Life Cycle

When a female Anopheles mosquito penetrates human skin to obtain a blood meal, it injects saliva mixed with an anticoagulant (blood clot preventer). If the mosquito is infected with Plasmodium, it will also inject elongated sporozoites (motile, spindle shaped asexual cells) into the bloodstream of its

victim. The sporozoites travel to the liver where they enter liver cells and rapidly divide asexually. This asexual division, which is called schizogony, generates the next life cycle form, called merozoites. The released merozoites invade other liver cells and enter the host’s bloodstream, where they invade erythrocytes (red blood cells). Once inside the erythrocyte, the merozoite begins to enlarge as a uninucleate cell termed a ring trophozoite. The trophozoite’s nucleus then divides asexually to produce a schizont which contains several nuclei. The schizont then divides and produces mononucleated merozoites. The erythrocyte then ruptures and releases toxins throughout the body of the host, bringing about the well-known cycle of fever and chills that is characteristic of malaria.

Plasmodium enters a sexual phase when some merozoites in the erythrocytes develop into gametocytes, cells capable of producing both male and female gametes. Erythrocytes containing gametocytes do not rapture. Gametocytes are incapable of producing gametes within their human hosts and do so only when they are extracted from and infected human host by a mosquito. Within the gut of the mosquito, the gametocytes form male and female gametes. The resultant diploid zygotes develop within the mosquito’s intestinal walls and ultimately differentiate into oocysts. Within the oocysts, repeated mitotic divisions take place, producing large numbers of sporozoites. These sporozoites migrate to the salivary glands of the mosquito, and from there are injected by the mosquito into the bloodstream of a human, thus starting the life cycle of the parasite again.

Taxonomy

Malaria is caused by protozoan parasites of the genus Plasmodium. Four species of Plasmodium can produce the disease and affect humans in its various forms:

Plasmodium falciparum

Plasmodium vivax

Plasmodium ovale

Plasmodium malariae

P. falciparum

P. malariae

P. ovale

P. vivax

Location

Tropical and Subtropical areas of C. &S. America, Africa, and S. E. Asia

Tropical and subtropical areas of C. &S. America, Africa, and S. E. Asia

Primarily in Sub-Saharan Africa

C. &S. America, India and S. E. Asia

Taxonomic Classification

Kingdom

Sub-Kingdom

Phylum

Class

Order

Family

Genus

Species

Plasmodium belongs to the kingdom Protista, characterized as a unicellular organism which is neither plant nor animal, being eukaryotic. It belongs in the class Sporozoasida which is a Sub-Kingdom of Protozoa exhibiting both sexual and asexual phases. (Sporozoasida, 2010), (Protists)

Plasmodium belongs to the family Plasmodiidae, order Eucoccidiorida and phylum Apicomplexa. With 450 currently recognised species in this order, many species of this order are still undergoing re-evaluation of their taxonomy with DNA analysis. It seems expected that many of these species will be re-assigned after these studies have been completed; these analyses will allow much more precision. (Plasmodium, 2010)

Symptoms/Pathology and Current Treatment

Symptoms can appear any time from six days after you are bitten by a mosquito carrying the malaria parasite. The time it takes for symptoms to

appear (the incubation period) can vary with the type of parasite that the mosquito was carrying (falciparum, ovale etc.).

The classical malaria attack lasts 6-10 hours. It consists of

- a cold stage (sensation of cold, shivering)
- a hot stage (fever, headaches, vomiting; seizures in young children)
- a sweating stage (sweats, return to normal temperature, tiredness).

(Malaria)

If bitten by a mosquito containing the P. falciparum parasite, the symptoms will usually develop within three months of the bite, but, most generally start between seven and 30 days.

If a mosquito carrying the P. vivax, P. ovale or P. malariae parasite infects a human, it is possible for the symptoms to emerge a year or more after the bite. This is because the parasite can lay dormant in the liver and become active months later. These parasites may also cause the human host to have the recurring symptoms (IAMAT, 2010).

The most typically used medicine when travelling, to prevent malaria, is the Chloroquine Drug:

(IAMAT, 2010)

Issues and Concerns

None of the available anti-malarial drugs are entirely safe and free of any side effects. Careful considerations must be given to the level of side effects of the anti-malarial drugs against the risk of contracting malaria.

Considerations such as travel destinations and period of stay, types of malaria present and prevalence of risk at the travel destination, types of drugs available and level of malaria resistance associated with these drugs are one of great importance. Side effects and complication from anti malaria drugs are a lot more serious in pregnant women and young children. Therefore recommendations and prescription of any anti-malaria drugs before travelling to malaria infected areas must be discussed and assessed by the individual's medical practitioner. (NCBI, 2004)

The disease is endemic in 91 countries currently, with small pockets of transmission in a further eight. Malaria is generally endemic in the tropics, with extensions into the subtropics. Countries which have regions where malaria is endemic as of 2003 (coloured yellow). Countries in green are free of indigenous cases of malaria in all areas.

Human Impact

To fight malaria, we already have a set of tools that canprevent malaria's spread, keep people from dying and (in the process)demythologize the disease. Early efforts at treatment focused on the development of medicines to fight the disease. This resulted in the parasite developing resistance to the drugs. Subsequently, disease prevention has focused primarily on treatment of stagnant water since mosquitoes breed and develop in such places. So far, effective precautionary measures that must be implemented in malaria endemic regions are:

1. Using mosquito nets to avoid being bitten by the insects
2. Using prescribedmalaria drugs to kill the parasite before it incubates

3. Eradicating mosquito breeding sites
4. Wearing long-sleeved clothing
5. Applying insect repellent creams when outdoors

With these safety measures established, humans have provided a much safer and preventable environment. With more processes developing, it is only a matter of time before this disease becomes completely preventable; scientists are trying to develop a vaccine which will be able to immune the disease. Overall it has been a success and human endeavours will continue to proceed. (Foundation, 2010)

How can humans further help the situation? If communities are educated on how to maintain a malaria vector-free environment, as well as provide families with insecticide treated bed-nets, it will be possible to reduce the prevalence of malaria illnesses and deaths in children by at least 50%. Other possible solutions would be to ensure high level of sanitation in the affected communities. Keeping clean surroundings would be a possible way to exclude these blood-sucking pests. Preventative anti-malarial medications are currently available and further research is being conducted into developing better and more effective drugs, including intense scientific efforts to develop an effective malaria vaccine.

It’s just up to the travellers to remember the travelling safety precautions, and for those who live in malaria endemic regions, must take further actions if it be medication, sanitation, eradication, or education. Where poverty is present, further precautions to this detrimental disease would be limited; thus, many people all over the world are trying to help save lives. For example, Bill Gates and his wife are doing the mission impossible of trying to

completely eradicate the malaria disease by donating billions of dollars to scientists and researchers, and also educating many people all over the world (Gates, 2010). Malaria kills roughly two million children per year around the world, and must therefore be considered a very serious threat to malaria-endemic communities. (Negus)