

A Journey of Malaria Treatment: An Overview

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Abstract

Mosquitoes carry the parasite disease malaria, which commonly causes fever, chills, and flu-like symptoms in its victims. International health efforts provide bed nets that have been treated with pesticide and drugs to prevent malaria. The two major classes of modern antimalarial drugs were developed from traditional treatments and have been used to treat malaria for a very long time. Pure items having antimalarial qualities that are comparable to or stronger than current antimalarial drugs and resistance in general. Antimalarial ~~meds~~ are sporadically given to those at risk in order to get rid of the disease-causing parasites that cause malaria and prevent illness.

Keywords: Malaria, Antimalarial drugs,

Introduction

Malaria is a sponging complaint which is spread by mosquitos, individuals infected with malaria

frequently witness high temperature, shivering and cold-like illness [1]. When deserted they may progress acute predicaments and the patients may die [2]. International health resources distribute malaria prevention medicine and mosquito nets to protect people in their sleep from mosquito bites. Children who live in countries with a widespread of malaria cases are guided to use a malaria vaccination, according to the World Health Organization[1].

Protozoal spongers among the rubric Plasmodium are the pathogens of malaria [3]. Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae, Plasmodium ovale curtisi, P. ovale wallikeri and Plasmodium knowlesi are the six organisms which beget malaria in human beings, out of that Plasmodium falciparum is the most deadly species [4]. Mosquitoes of the breed Anopheles transmit the spongers. The parasites first infect liver cells in an initial asymptomatic manner after being transmitted by an infected mosquito [3].

Prevalence

Malaria is a complaint that has tormented humans since the old era and is still among the contagious conditions having lofliest fatality rates at the moment. Due to this, a number of global initiatives to decrease and eradicate malaria have been launched, including malERA, an investigation program for malaria eradication. [5].

The World Health Organization has published global evaluations of the fatalities from malaria since the turn of the centennial. The worldwide threat fell past nearly forty percent in the middle of 2000 and 2015, from 896,000 in 2000 to 562,000 in 2015 but advancement has also slowed down ever since. Because of the Coronavirus outbreak, the number of fatalities literally elevated in 2020 [6-7].

As claimed by the rearmost malaria report, malaria incidents elevated from 227 million t to 241 million between 2019 and 2020. Around 627,000 people were anticipated to die from malaria in 2020 which is a rise of 69,000 fatalities higher than 2019 [7-8].

Treatment

Antimalarials are the naturally derived drugs which are used to prevent and treat malarial infection [9]. Drug classes and duration of treatment is bound to differ determined by exactly what kind of malaria sponger an individual has, how severe the complaints are, age and in other cases gestation [10]. Young children and pregnant women are the two important and vulnerable target groups of human [11].

If used instantly as antimalarials or rather main chemical compounds for the development of new strong medications, herbs persue to provide an important legacy to the treatment for malaria [12].

I. Traditional system of treatment

Artemisinin and quinine derivatives which are the important span of classes of contemporary antimalarial medications have their origins in traditional remedies and have been used to treat malaria for thousands of years [13]. One-fourth of all prescription medications worldwide are mostly derived from plants. Herbs are more frequently employed as an optimal kind of

treatment in healthcare than medications [15]. Traditional medicines may be a significant and long-term source of therapy because to the issues of rising levels of medication resistance and the challenges of Numerous plant species have been able to show their usefulness. Pure products with antimalarial properties that is equivalent to or more potent than the modern antimalarial medicine and resistance in general. Therefore, it is essential that the research of antimalarial drugs be continued, using these highly effective medicines, through preclinical and clinical testing, production and distribution, and eventually post-marketing pharmacovigilance. [14].

Table 1[15] shows the plants species which possess antimalarial activity and are currently being used to treat malaria and its symptoms.

Table 1. Plant species possessing antimalarial activity.

Plant	Plant part	Formulation	Dose
<i>Aegle marmelos</i>	Leaves	Decoction of leaves.	
<i>Allium sativum</i>	Bulb	Tinctures, infusions and concoctions.	
<i>Alstonia boonei</i>	Stem, root, leaves and bark	Decoction, tincture or infusion can be made	
<i>Anacadum accidentallis</i>	Leaves	Decoction	300ml, once a day.
<i>Andrographis paniculata</i>	Full plant	Decoction	
<i>Andropogon schoenanthus/nardis</i>	Leaves	Decoction	
<i>Aspilla Africana, Bambusavulgaris</i>	Leaves	Concoction	
<i>Azadirachta indica</i>	Stem, bark and leaves	Decoction	
<i>Azadirachta indica, Caricapapaya, Psidium guajava, Eucalyptus citsodora, Mangifera indica</i>	Leaves	Concoction	300ml, 2 times a day
<i>Azadirachta indica, Ocimum gratissium</i>	Leaves	Concoction	
<i>Azadirachta indica, Psidium guajava, Carica papaya</i>	Leaves	Concoction	300ml, 2 times a day.
<i>Bambusa vulgaris, Uwariachamae, Cymbopogoncitratatus</i>	Leaves	Decoction	300ml, 4times a day.
<i>Cactus opunita</i>	Leaves	Decoction	300 ml, once a day.
<i>Carica papaya</i>	Fruit, seed and leaves	Infusion	
<i>Carica papaya, Mangiferaindica</i>	Leaves	Concoction	300ml, 2 times a day.
<i>Cinnamosma fragrans</i>	Leaves and bark	Decoction	1 bowl, 3-4 times a day.
<i>Citrus aurantifolia</i>	Leaves	Tisane	
<i>Citrusaurantifolia, Cymbopogon citrates, Eucapyptus citrissodora, Psidium guajava.</i>	Leaves	Concoction	300ml, once a day.
<i>Curcuma longa</i>	Rhizome	Tincture and decoction	

<i>Cymbopogon citrates, Eucalyptus citriodora, Phyllanthus amarus</i>	Leaves	Concoction	300ml, 3 times a day.
<i>Cymbopogon citrates</i>	leaves	Infusion	300ml, 2 times a day.
<i>Desmodium mauritianum, Desmodium hirtum</i>	Leaves and bark	Decoction	1 bowl, 3 to 4 times a day.
<i>Dracaena reflexa</i>	Leaves and bark	Decoction	1 bowl, 3 to 4 times a day.
<i>Enantia chlorantha</i>	Bark	Decoction and infusion	
<i>Ficus megapoda</i>	Leaves and bark	Decoction	1 bowl, 3 to 4 times a day.
<i>Funtumia africana</i>	Root	Decoction	
<i>Garuga floribunda</i>	Bark	Decoction	
<i>Gongronema latifolium</i>	Leaves	Decoction	300ml, 3 times a day
<i>Gongrononama latifolium</i>	Leaves	Decoction	300ml, 3 times a day
<i>Khaya grandifoliola</i>	Bark	Decoction and infusion	
<i>Leconiodiscus cupanioides</i>	Roots	Decoction	
<i>Cinnamosma fragrans</i>	Leaves and bark	Decoction	1 bowl, 3-4 times a day.
<i>Citrus aurantifolia</i>	Leaves	Tisane	
<i>Citrus aurantifolia, Cymbopogon citrates, Eucalyptus citrissodora, Psidium guajava.</i>	Leaves	Concoction	300 ml, once a day.
<i>Curcuma longa</i>	Rhizome	Tincture and decoction	
<i>Cymbopogon citrates, Eucalyptus citriodora, Phyllanthus amarus</i>	Leaves	Concoction	300ml, 3 times a day.
<i>Cymbopogon citrates</i>	leaves	Infusion	300 ml, 2 times a day.
<i>Desmodium mauritianum, Desmodium hirtum</i>	Leaves and bark	Decoction	1 bowl, 3 to 4 times a day.
<i>Dracaena reflexa</i>	Leaves and bark	Decoction	1 bowl, 3 to 4 times a day
<i>Enantia chlorantha</i>	Bark	Decoction, and infusion.	Tincture
<i>Ficus megapoda</i>	Leaves and bark	Decoction	1 bowl, 3 to 4 times a day
<i>Funtumia africana</i>	Root	Decoction	
<i>Garuga floribunda</i>	Bark	Decoction	
<i>Gongronema latifolium</i>	Leaves	Decoction	300ml, once a day
<i>Gongrononama latifolium</i>	Leaves	Decoction	
<i>Khaya grandifoliola</i>	Bark	Decoction and infusion	
<i>Leconiodiscus cupanioides</i>	Roots	Decoction	
<i>Mangifera indica, Citrus aurantifolia</i>	Roots and leaves	Decoction	300ml, 3 to 4 times a day.
<i>Morinda lucida</i>	Stem and root leaves	Tincture and infusion.	
<i>Nauclea latifolia</i>	Bark and roots	Tincture and decoction	
<i>Nymphaea lotus</i>	Leaves and bark	Decoction	1 bowl, 3 times a day.
<i>Ocimum gratissimum</i>	Leaves	Filtrate of the juice	
<i>Peddiea involucrata</i>	Leaves and bark	Decoction	1 bowl, 3 times a day.
<i>Psidium guajava, Citrus aurantifolia, Carica papaya, Annona comosus</i>	Leaves	Concoction	300ml, once a day.

<i>Pterocarpus</i>	Leaves	Filtrate	300ml,3 timees a day.
<i>Pterocarpus santalinoides</i> , <i>Caesalpina</i>	Leaves	Filtrate	
<i>Rauvolfia vomitoria</i>	Roots	Decoction	
<i>Sida acuta</i>	Leaves and stem	Infusion	Half a glass, 2 times a day.
<i>Solanum spp.</i>	Leaves	Filtrate	
<i>Solanum spp.</i> , <i>Pterocarpus santalinoides</i>	Leaves	Concoction	300ml, once a day.
<i>Tithonia diversifolia</i>	Leaves	Infusion	
<i>Tristellateia madagascariensis</i>	Leaves	Decoction	2 to 3 glasses a day.
<i>Uvaria chamae</i> , <i>Caesalpinia pulcherima</i>	Roots and bark	Infusion	300ml, 2 times a day.
<i>Vepris ampody</i>	Leaves and bark	Decoction	1 bowl, 3-4times a day.
<i>Gongronema latifolium</i>	Leaves and bark	Decoction	1 bowl, 3-4 times a day.

II. Modern (synthetic) system of treatment

Antimalarial medications primarily work to get rid of the stages in which the malaria spongers have infected the red blood cells that causing human sickness. *P. falciparum* and *P. vivax*, which are the abundant malaria spongers, are treated with different drug regimens [16]. The optimal antimalarial medication must meet a wide range of criteria. Since young children and pregnant women, two particularly vulnerable populations, are significant target populations, the compound should be highly effective, well tolerated, and have a very good safety profile for the treatment of uncomplicated malaria [17]. Table 2 shows the current medications which are currently used to treat malaria with respect to dose given to adults and children.

The best treatments for straightforward falciparum malaria are now widely acknowledged to be artemisinin-based combination therapies (ACTs) [19]. Since the early 1990s, ACTs have been used to treat malaria. Southeast Asia was in a dire state at the time; mefloquine, sulfadoxine-pyrimethamine (SP), and chloroquine had all been used in succession but had failed due to resistance [9]. ACT is made up of a powerful artemisinin component that effectively kills most parasites quickly and a longer-acting companion medicine that finishes off any residual parasites and prevents the development of artemisinin resistance [16].

These artemisinins work on the transmissible sexual stages of Plasmodium parasites as well as the pathogenic asexual blood stages. These combinations boost clinical and parasitological cure rates and lessen the pressure that leads to the establishment of antimalarial resistance [18].

Table 2: A Summary of the notably used antimalarial medicine.

Class	Generic name	Dosage form/route of administration	Dose
Cinchona alkaloids [20]	Quinine [20]	Capsule/oral route [21]	Adults: 648 mg after every 8 hours for 7 days [21] Children (16 years or older): 648 mg after every 8 hours for 7 days [21]
	Quinidine [20]	Injection/IV route [22]	Adults: 24 mg/kg in a solution injected slowly for 4 hours. Then, 8 hours after the first dose, 12mg/kg, injected slowly for 4 hours, and repeated every 8 hours [22]. Children: Dose is determined by doctor [22].
4-Aminoquinolines [20]	Chloroquine [20]	Tablets/oral route [23]	Adults: 1000mg once a day. 500mg 8 hours after the 1 st dose then 500mg on the second and third days [23]. Children: 10mg/kg then 5mg/kg taken 6hrs, 24hrs and 36hrs after the 1 st dose [23].
	Hydroxyl-chloroquine [20]	Tablets/oral route [24]	Adults: 800mg taken once. 400mg is then taken 6hrs, 24 hrs. and 48hrs after the 1 st dose [24] Children: 13mg/kg is taken as single dose. 6.5mg/kg is then taken 6hrs, 24hrs and 48hrs after the 1 st dose. NB: should not be recommended for children weighing less than 31kg [24].
	Mefloquine [20]	Tablets/oral route [25]	Adults: 1250mg or five tablets as a single dose [25]. Children: 20mg/kg to 25mg/kg as a single dose or two doses taken after 8 hours. NB: For children younger than 6 months, dose is determined by the doctor [25]
8-Aminoquinolines [20]	Primaquine [20]	Tablets/oral route [26]	Adults: 15mg once a day for 14 days [26]. Children: Dose is determined by the doctor [26].
Polycyclics [20]	Doxycycline [20]	Tablets (capsules)/oral route [27]	Adults: 100mg to be taken after every 12 hours. Then, take 100mg once a day after the 1 st dose [27] Children: Dose is determined by the doctor [27].
	Halfantrine [20]	Tablets/oral route [28]	Adults: 500 mg is taken on an empty stomach after every 6 hours for 1 week [28]. Children: Dose is determined by the doctor [28]
Artemisinin family [20]	Artemisinin [20]	Tablets/oral route [20]	10-20 mg/kg on the first day, then 500 mg per day for 4 days [20].
	Artemether [20]	Tablets/oral route [29]	Adults: 4 tablets are taken as a single dose, then one dose after 8 hours. On days 2 and 3, one dose is taken twice a day. [29] Children: Dose is determined by the doctor. [29]

	Artesunate [20]	Injection/IV route [30]	<p>Adults: 2.4 mg/kg in a solution is injected slowly (bolus over 1 to 2 minutes) at 0 hours, 12 hours, and 24 hours. Then after continue once daily until the patient is able to take oral medicine [30].</p> <p>Children: Dose is determined by the doctor. [30]</p>
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Prevention (vaccination):

To eliminate malaria-causing parasites and prevent sickness, antimalarials are intermittently administered to vulnerable individuals [31].

Important experiments in mice utilising irradiation sporozoites served as the foundation for the creation of the contemporary malaria vaccine. Even if there is still no licenced product more than 50 years later, it is crucial to keep in mind the extent of the scientific and technical obstacles facing those who create vaccines against such a sophisticated eukaryotic parasite [32].

According to the stage of parasite development that is targeted, malaria vaccines are divided into three categories: pre-erythrocytic, blood stage, and transmission-blocking. Certain immunizations may concentrate on a number of developmental stages. An ideal malaria vaccine would totally stop the initial stages of parasite growth, inhibit the development of later stages, and stop transmission. [33].

A subunit malaria vaccine called RTS,S/AS01 protects against Plasmodium falciparum's pre-erythrocytic stage [31]. A partnership between GlaxoSmithKline (GSK) and the Walter Reed Army Institute of Research (WRAIR) that started in 1984 resulted in the development of the RTS,S vaccine in 1987. Based on proof-of-concept experiments showing that radiation-attenuated sporozoites protected against malaria infection at the time, both organisations were working to create a vaccine [33].

Between 2009 and 2014, thousands of young children in seven African nations participated in a number of clinical studies to test the RTS, S/AS01 malaria vaccine. The results revealed that children who got the vaccination did not have severe malaria [35]. RTS,S/AS01 was the first malaria vaccine that the WHO advocated for use in sub-Saharan Africa settings with moderate- to high malaria transmission in 2021 [36].

Conclusion

By the year 2050, malaria, one of the oldest and deadliest illnesses to ever affect humans, should and can be wiped out. Under the status quo, malaria will not be eliminated. To ensure eradication, specific and crucial activities are needed at the national, regional, and international levels. A worldwide commitment to pursue malaria eradication as a specific, time-bound objective would support these initiatives.

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