Journal of the Egyptian Society of Parasitology, Vol. 53, No.2, August 2023
J. Egypt. Soc. Parasitol. (JESP), 53(2), 2023: 267 – 278
Online: 2090-2549

EPIDEMIC MALARIA: IS IT THREATENING TO EGYPT WITH THE TRAVELERS AND IMMIGRANTS THROUGH THE SOUTHERN BORDERS?

By
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Abstract

Malaria is a serious and sometimes fatal disease caused by *Plasmodium* species that infects *Anopheles* mosquito which feeds on humans. But, as malaria parasites live in the RBC, infection also occur by blood transfusion, organ transplantation, shared contaminated needles or stick-injury, and placental transmission with perinatal outcomes such as stillbirth, low birth weight, preterm birth, and small-for-gestational-age neonates. Malaria patients are typically very sick with high fevers, shaking chills, and flu-like illness; but these symptoms may be mild and difficult to diagnose malaria. The severe infection may cause kidney failure, seizures, mental confusion, coma, and death. Man is infected by *P. falciparum, P. vivax, P. ovale* subspecies, *P. malariae, & P. knowlesi*, with *P. falciparum* results in severe infections, which may be miss-diagnosed with zoonotic babesiosis. Although malaria can be a deadly disease, illness and death from malaria can usually be prevented.

Nowadays, migrants from endemic countries constitute a high proportion of imported malaria cases in non-endemic countries

Keywords: Egypt, Malaria imported, Southern borders, Travelers, Immigrants, A review.

Introduction

Malaria is an important cause of fever and serious illness in returned travelers (Leder *et al,* 2004). Among nearly 7000 returned travelers with fever seen at a Geo-Sentinel clinic between 1997 and 2006, for example, malaria was the most common specific etiologic diagnosis, found in 21% of cases (Wilson *et al,* 2007). The relative risk of malaria is higher among returned travelers from sub-Saharan Africa than those from Asia or the Americas (Askling *et al,* 2005).

A total of 1724 cases of imported malaria reported in 2014 to the United States CDC (Mace and Arguin, 2017). More than half of the reported cases are due to *Plasmodium falciparum*, which causes the most severe disease; patients with *P. falciparum* may progress to life-threatening illness within hours (Hwang *et al,* 2014). Since 1997, there was an average of six malaria deaths per year in the United States (Taylor *et al,* 2013). The greatest number of imported malaria cases was the United Kingdom, France, Italy and Germany, with *P. falciparum* up to 70% of all cases.

Prevention efforts must be for the malaria six human species; *P. falciparum, P. vivax, P. ovale wallickeri, P. o. curtisi, P. malariae, & P. knowlesi* (Milner, 2018). But, *P. falciparum* is commonest to result in severe disease, all species can cause risk disease and death (Kochar *et al,* 2005). Generally, all chemoprophylaxis drugs were designed to prevent primary malaria attacks. But, efficacy of various chemoprophylactic regimens varied by geographic region; even in areas without reported resistance, chemoprophylaxis was not 100% effective, and may delay the malaria symptom onset, and most chemoprophylactic regimens do not prevent relapse of *vivax* malaria (Chen *et al,* 2007).

Primaquine can also prevent relapses of malaria caused by *P. vivax* & *P. ovale* (Lan-

dman *et al,* 2015). Most travelers developed as they didn't adhere to an effective chemoprophylactic drug (Svenson *et al,* 1995). Also, many travelers frequently fail to use personal protective measures to avoid *Anopheles* bites or other vectors borne diseases (Krause *et al,* 2006). The risk of malaria local transmission depends on a variety of factors including the visited geographic region, traveler type, and the *Anopheles* vector (Freedman, 2008).

Review and Discussion

Destination: In addition to the geographic region visited, the risk of malaria transmission depends upon the type of accommodation (e.g., open air, tented, air conditioned, or screened), the season (rainy versus dry), the elevation, and the duration of exposure. Geographic risk assessment for malaria requires a detailed review of the planned itinerary together with the most recent United States CDC (2015a) guidelines and advisories. Listings of regions where malaria transmission occurs, the presence of antimalarial drug resistance, and recommended chemoprophylaxis for specific destination are available in CDC publications "Health Information for International Travel" (also known as the Yellow Book), accessed online (CDC, 2017). An interactive malaria map is also available (WHO, 2015a), which provided useful online information including maps and malaria data. An good summary of areas where malaria transmission occurs and country prophylaxis available (CDC, 2015b).

Traveler types: Important risk groups include travelers born in regions with endemic malaria that relocate outside the endemic area but subsequently return to visit friends and relatives (known as VFRs), pregnant women, and military personnel. VFR travelers are at greatest risk for malaria infection; this group includes individuals born in regions with endemic malaria who have emigrated outside these regions, as well as the subsequent family generation of children born outside endemic areas (Askling *et al,* 2005). VFRs pose unique challenges for malaria prevention since their acquired immunity afforded some degree of protection against malaria while they resided in the endemic area, although such immunity wanes outside endemic regions (Fenner *et al,* 2007). But, such individuals may have difficulty seeking or accessing preventive services, may receive incorrect information regarding appropriate prophylaxis measures, and may not appreciate the risk or severity of infection once their immunity has waned (Leder *et al,* 2006). Among patients for whom reason for travel was known, 63% of the severe cases of imported malaria in 2013 were in VFRs (Bacaner *et al,* 2004).

The military personnel represent another important risk group. They may have inadequate protection from mosquito bites for long times acquired by night exposure to female *Anopheles* biting with accommodations having inadequate screens or bed-nets or even during night activities outside (Ciminera and Brundage, 2007).

Counseling: Travelers to malarias areas should understand that their planned itinerary puts them at risk for malaria, a serious infection that can be fatal after just several illness days. Prevention measures include avoiding mosquito bites and adhering to antimalarial chemoprophylaxis. But, travelers must also understand that no chemoprophylaxis regimen guarantees complete protection and that fever during or after travel is a medical emergency requiring urgent medical attention (Newman *et al,* 2004). Other symptoms may include headache, myalgia, cough, nausea, abdominal pain, vomiting, and diarrhea and cases that may progress to coma and death lies clinical spectrum of non-severe malaria, which generally occurs in semi-immune individuals. (Martins *et al,* 2015)

Travelers should be counseled that their travel history is an important clue to bring to the attention of the healthcare provider in the case of illness during the first year following exposure, as most chemo-prophylactic agents (except primaquine) do not eradicate the dormant liver hypnozoites of *P. viv-*

ax and *P. ovale* capable of causing relapsing malaria, infection with these species may persist for months following exposure in spite of full adherence to the chemoprophylaxis (Schwartz *et al,* 2003). In semi-immune individuals born in endemic areas, *P. falciparum* may persist for years after last period of exposure (D'Ortenzio *et al,* 2008).

Travelers planning prolonged visits to endemic areas must continue prophylaxis during all their stay and the recommended period of time afterward. Local laboratories in developing regions may have high rates of false-positive malaria diagnoses; travelers who become ill must be advised to seek expert advice concerning malaria diagnosis and therapy (Causer *et al,* 2004). No doubt, inhabitants residing in malaria-endemic countries progressively acquire a certain degree of immunity against clinical complications and high parasitemia, but with neither a sterile immunity nor prevent malaria re-infection (Mischlinger *et al,* 2022). Also, in malaria endemic areas, natives who developed partial immunity may be infected but, without symptoms (WHO, 2022a). In this case, the chemoprophylactic regimen must be continued together with treatment offered locally, unless there was significant drug-drug interaction, as Mefloquine® and Halofantrine® (Reyburn *et al,* 2004). If the initial evaluation demonstrates negative blood films, thick and thin blood films or rapid diagnostics must be repeated twice with 12 to 24 hours apart (Keystone, 2004).

Pregnant women are an important risk group, as malaria can be a life-threatening infection for both mother and fetus (Roggelin and Cramer, 2014). Risk of stillbirth, spontaneous abortion, and other adverse pregnancy outcomes are increased in the malaria setting; pregnant travelers must be advised to defer travel until post-delivery whenever feasible (Al-Agroudi *et al,* 2017).

Mosquito bite prevention: Travelers to malarias areas must be instructed regarding methods to prevent bites from *Anopheles* mosquitoes; such measures to reduce bites from sandflies, ticks, and other mosquito species. These include (Lupi *et al,* 2013): 1- Avoiding outdoor exposure between dusk & dawn (when *Anopheles* mosquitoes feed), 2-Wearing clothing to reduce the amount of exposed skin, 3- Wearing insect repellant clothes, 4- Sleeping within bed-nets treated with insecticide (as permethrin), 5- Staying in well-screened or air-conditioned rooms. Insect repellents recommended by the United States/CDC to reduce the malaria risk with N, N-diethyl-m-toluamide (DEET) and picaridin (Fradin and Day, 2002). The wear light-colored, long-sleeved shirts and long trousers, tucked into socks or boots, and use of insect repellent on exposed skin and clothing to protect from being bitten by mosquitoes, sand-flies and/or ticks (Morsy *et al,* 2029). DEET (30 to 50%) is generally protective for at least four hours, although lower percentage preparations provide a shorter duration of protection. When used appropriately, this same concentration of DEET is safe for infants and children over two months old. Picaridin is a synthetic repellant. This agent (20%) and DEET (35%) have comparable protection efficacy against malaria vectors up to eight hours after application (Frances *et al*, 2004). In addition to applying insect repellants to the skin, fabric may be treated with permethrin or other residual insecticides (Kimani *et al,* 2006). Permethrin is a synthetic compound that causes nervous system toxicity to insects with low toxicity for humans (Fradin, 1998). It was available in outdoor supply stores as an aerosol clothing spray e.g., Permanone repellent (Faulde *et al,* 2003). Clothing and bed netting treated with permethrin effectively repel mosquitoes for more than a week even with washing and field use (Lengeler, 2004). Standard nets permethrin dipped are effective for three washes, but newer formulations can with stand 20 washes. Long-lasting insecticide impregnated nets (LLINs) can remain effective as long as three years. Since use of such nets is very effective for reducing malaria risk, travelers to endemic areas with accommoda-

tions lacking screens or air conditioning (such as travelers visiting friends and relatives [VFRs] or hikers) must sleep under insecticide-treated net (Onyeneho, 2013).

Chemoprophylaxis of the traveler itineraries must be reviewed together with the guidelines and advisories to select appropriate chemoprophylaxis approach (WHO, 2022b).

Listings of regions where malaria transmission occurs, antimalarial drug resistance, and recommended chemoprophylaxis for specific destination were given (CDC, 2022). Also, the Health Information for International Travel or Yellow Book (CDC, 2023), and WHO (2023) provided useful online information including maps and malaria data.

Selection of chemoprophylaxis must be tailored to individual itineraries and circumstances. For patients traveling to several destinations with different types of malaria transmission patterns, it may be simplest to select a single agent that will be effective for the entire duration of exposure; 1- For travelers to destinations where malaria cases occur only sporadically and risk was very low, mosquito avoidance measures should be used; no chemoprophylaxis is needed. 2- For travelers to malaria infection risk in destinations in chloroquine-resistant *P. falciparum* malaria, mosquito avoidance measures must be combined with chemoprophylaxis. Options include atovaquone-proguanil, mefloquine, and doxycycline; all three agents were highly efficacious for prevention of malaria. Comparative studies among travelers taking mefloquine or atovaquone-proguanil have mild side effects among atovaquone-proguanil recipients, but more costly (van Riemsdijk *et al,* 2002). Short-term travelers may prefer shorter course of atovaquone-proguanil, whereas long-term travelers may prefer weekly mefloquine. Doxycycline requires a prolonged course, must be taken daily, and may cause sun sensitization. 3- For travelers to malaria infection risk in destinations with *P. vivax* predominance (parts of Mexico and Central America), mosquito avoidance measures must be used combined with chemoprophylaxis. Primaquine may be used in absence of (G6PD), chloroquine was effective. Short-term travelers may prefer the shorter course of atovaquone-proguanil. Mefloquine and doxycycline are also effective agents (Steinhardt *et al,* 2011). 4- For travelers to malaria infection risk in *P. falciparum* strains resistant to chloroquine, mefloquine, and sulfonamides were used (in endemic regions of Thailand bordering Burma and Cambodia e.g., eastern provinces of Burma and western provinces of Cambodia, China, Laos, & Vietnam, mosquito avoidance must use combmbined chemoprophylaxis. Options were atovaquone-proguanil or doxycycline.

Antimalarial therapy should be started prior to travel, continued regularly during exposure, and for a period of time following departure from the endemic area (Chen and Keystone, 2005). A prescription for the full supply of medication should be written and filled before departure; sale of counterfeit and poor quality anti-malarial was an increasing problem in Asia and Africa (Bate *et al,* 2008). Travelers should understand the importance of careful adherence to the chemoprophylaxis regimen, even though none regimen guarantees complete protection (Dondorp *et al,* 2004). But, all chemoprophylaxis agents vary with respect to cost, adverse effects, and dosing schedule (Chen *et al,* 2007). So, travel must visit the facilitating adherence (CDC, 2016).

Atovaquone/proguanil may well become the first line drug combination in treatment & prophylaxis of malaria, due to its excellent safety profile and oral administration, daily with food beginning one to two days prior to exposure, during exposure, and for a week after exposure (Berman *et al,* 2001). It acts synergistically with proguanil against chloroquine-sensitive and chloroquine-resistant *P. falciparum*, and as other zoonotic malaria (Mustafa and Agrawal, 2011), with efficacy equivalent to mefloquine (Overbosch *et al,* 2001), and well tolerated, with excellent safety profiles (Ling *et al,* 2002). Adverse effects may include gastrointestinal

upset, insomnia, headache, rash, and mouth ulcers (Camus *et al,* 2004). Atovaquone-proguanil didn't prevent hypnozoite formation by *P. vivax* or *P. ovale*; in highly infected areas due to these species, presumptive anti-relapse therapy with primaquine may be indicated to prevent relapse for persons who had been to those areas for extended periods of time (Schwartz, 2012).

Mefloquine is effective for malaria prevention due to chloroquine-sensitive and chloroquine-resistant *P. falciparum*, and other human malaria species (McKeage and Scott, 2003). Tickell-Painter *et al.* (2017) among 140,000 travelers to East Africa, mefloquine prophylactic efficacy was 91%. But, it was not effective for malaria prevention due to mefloquine-resistant *P. falciparum*, found along the Thailand-Cambodian border region and parts of China, Burma (Myanmar), Vietnam, and Laos (Saleh *et al,* 2016). Also, it didn't prevent development of residual hepatic hypnozoite forms of *P. vivax* or *P. ovale* malaria, but presumptive that anti-relapse therapy with primaquine may prevent relapse (Steffen *et al,* 1993).

Mefloquine is given weekly beginning at least two weeks prior to exposure, during exposure, and for four weeks after exposure. Some travelers experience adverse effects from mefloquine; most were mild, self-limited, and didn't require discontinuation of the drug as its adverse effects were gastrointestinal upset, lightheadedness, headache, difficulty concentrating, mood swings, and strange dreams (Styka and Savitz, 2020). About 5% of travelers experience disabling neuropsychiatric adverse effects required its stop, as anxiety, depression, nightmares, paranoid ideation, and dizziness (Boggild *et al,* 2007). About 1/10,000 showed severe neuropsychiatric effects as seizures and psychosis with adverse effects more among women but, less among children (Schlagenhauf *et al,* 2011).

Mefloquine contraindications include hypersensitivity, a history of seizures, or major psychiatric disorder and a recent history of depression or anxiety. Development of psychiatric symptoms (such as depression, anxiety, restlessness, or confusion), while taking mefloquine must be examined as a possible prelude to other events; in such circumstances, it is advisable to stop the drug immediately and switch to a different prophylaxis agent. Mefloquine has also been associated with sinus bradycardia and QT interval prolongation; therefore, it should be used with caution in patients with cardiac conduction disorders (CDC, 2015c). For pregnant women who cannot delay travel to chloroquine-resistant *P. falciparum* area, mefloquine can be safely given during all trimesters (Pang *et al,* 1987). Ahmad *et al.* (2021) in India reported that many countries as the United States and the United Kingdom have updated their drug boxes to include warning of these potential neuropsychiatric effects

Doxycycline has activity against chloroquine-sensitive and chloroquine-resistant *P. falciparum*, as well as other zoonotic malaria species (Tan *et al,* 2011). Comparative trials showed that equivalent efficacy of doxycycline with mefloquine as 93 to 99% (Ohrt *et al,* 1997). Doxycycline can give some protection against some rickettsial diseases (as scrub typhus), and *Leptospira* spp. (Takafuji *et al,* 1984). But, doxycycline didn't prevent development of residual hepatic hypnozoite forms of *P. vivax* an/or *P. ovale* (Olson *et al,* 1980). So, for those with extended exposure to areas with high rates of infection due to these species, presumptive anti-relapse therapy with primaquine may be necessary to prevent relapse (Chu and White, 2021).

Doxycycline is administered daily beginning one to two days prior to exposure, daily during exposure, and daily for four weeks following exposure. Noncompliance (even for a few days) with this daily regimen is an important reason for its prophylaxis failure (Wallace *et al,* 1996).

Doxycycline is usually well tolerated but, being associated with gastrointestinal upset; less commonly, ultraviolet photosensitivity, *Candida* vaginitis, and rare esophageal ulceration cases may also occur (Phillips and

Kass, 1996). Doxycycline hyalites are a highly tolerated drug compared to its tetracycline counterparts and has limited evidence for causing serious adverse effects. The following are some of the rarely observed adverse events, Bloody diarrhea, Leukopenia, Migraines, Hemolytic anemia, Throat irritation or trouble swallowing Chest pain, Exacerbation of systemic lupus erythematosus, breath shortness, irregular or fast heart rate, dysuria, Intracranial hypertension, esophagitis/esophageal ulcerations if given without water (Patel and Parmar, 2023). It was advisable to give women antifungal self-treatment for *Candida* vaginitis (as fluconazole). But, doxycycline is contraindicated in pregnant women and children <8 years old (Salako, 1984).

Chloroquine may be used for prophylaxis for individuals traveling to malarias areas without chloroquine resistance (CDC, 2021). Chloroquine has activity against all plasmodial species causing human malaria with the exception of chloroquine-resistant *P. falciparum* strains and uncommon strains of *P. vivax* in Oceania and Asia (Lover *et al*, 2018). Also, chloroquine didn't prevent development of residual hepatic *P. vivax* hypnozoite forms (Rieckmann *et al,* 1989). *P. vivax* was a major morbidity malaria type, mainly in small children with repeated relapse causing severe anemia, malnutrition, and growth delay (Commons *et al,* 2019). Apart from chloroquine bad taste, side effects or intensify symptoms, as abdominal discomfort, nausea, vomiting, and diarrhea that may occur with primaquine (Goodman and Gilman, 2011). Retinal injury occurs by chloroquine high doses in rheumatoid arthritis treatment, didn't occur with the weekly doses for malaria, but chloroquine may be safe in pregnancy (Appleton *et al,* 1973).

Primaquine has activity against many stages of malaria parasite included hypnozoites, tissue schizonts, gametocytes and asexual *P. vivax* blood stages (Baird *et al,* 1995). It prevents relapses from hypnozoite forms of *P. vivax* & *P. ovale*, with *P. falciparum* gametocytes activity, with good protection against *P. falciparum* and *P. vivax* of 74 to 95% and 85 to 92%, respectively (Hill *et al,* 2006). Primaquine is given daily one to two days prior to exposure, once daily during exposure, and daily for a week post exposure (Baird *et al,* 2003). It can cause hemolytic anemia in those with G6PD deficiency (Luzzatto *et al,* 2020). So, a G6PD level must be determined prior to administration. It may also cause gastrointestinal upset, minimized if taken with food. Primaquine is contraindicated in pregnancy and breastfeeding.

Primaquine relapse prevention: Late-onset or relapsed disease due to re-activation of hypnozoites can occur up to many months after initial infection. Hypnozoites are a quiescent stage in the liver that exists only in the setting of *P. vivax* and *P. ovale* infection. Hepatic stages cause no fever symptoms, and one does not need to have had a primary clinical episode of malaria to have a relapse (Galappaththy *et al,* 2007). This was a must for travelers with long stays (several months or more) where *P. vivax* or *P. ovale* occurred (Schwartz *and* Regev-Yochay 1999).

Risk pregnant travelers: Malaria can be a life-threatening for mother and her fetus (Lindsay *et al,* 2000). Mosquito avoidance measures must be used in combined with chemoprophylaxis with chloroquine, and mefloquine was acceptable (Whitty *et al,* 2005).

Mefloquine may be safely given during all trimesters (Nosten *et al,* 1994). Doxycycline should not be given during pregnancy due to its potential adverse effects to fetus as dysplasia and inhibition of bone growth and dental discoloration. Primaquine must not be given (Vanhauwere *et al,* 1998). Moreover, mosquitoes' avoidance and other vector borne diseases is a must (Morsy, 2012).

Risk children travellers: All children traveling to malaria-endemic areas must have antimalarial prophylaxiss. Chloroquine and mefloquine are options for use in all infants and children. Atovaquone-proguanil may be given to that ≥5 kg; doxycycline may be administered to individuals' ≥8 years.

Drug interactions: Prior to prescribe antimalarial treatment, traveler's medication history must be reviewed with consideration for potential drug-drug interactions. Some relatively common drugs with important interactions include: 1- Warfarin has FDA approval for prophylaxis and treatment of venous thrombosis and its complications, as a pulmonary embolus (Crader *et al,* 2023). Atovaquone/proguanil may diminish warfarin metabolism. Coagulation parameters must be monitored closely if these drugs used together, and warfarin dosing may need to be reduced (Hidalgo *et al,* 2011), 2-Antiarrhythmic agents should be used with caution in setting of mefloquine given associated with sinus bradycardia and QT interval prolongation, & 3-Immunosuppressive medications as chloroquine may increase cyclosporine levels, and both doxycycline and mefloquine may increase cyclosporine and tacrolimus levels, Atovaquone-proguanil didn't have known interactions with these medications (Kotton *et al,* 2005).

Now what about Egypt? Generally, malaria continued to be a major drain on the health and economy of Africans, as 93% of the global malaria burden occurred in sub-Saharan Africa (WHO, 2019). Higher temperatures allow *Anopheles* mosquito to thrive. Malaria parasites, which grow and develop inside the mosquito, need warmth to complete their growth before they are mature enough to be transmitted to humans (CDC, 2022).

In Egypt, Zaher *et al*. (2007) reported 16 malaria cases in Almaza Military Fever Hospital, they were *P. falciparum* (9) imported pilgrims and *P. vivax* (7) locally acquired cases. El-Bahasawy *et al.* (2010) reported 20 malignant malaria cases among Peace Keeping Mission Forces back from the Sudan.

Mikhail *et al.* (2009) reported the abundance of 14 *Anopleles* species, of medical interest were *Anopheles sergentii, A. pharoensis*, *A. multicolor*, *A. algeriensis,* and *A. stephensi.* Malcolm *et al*. (2009) reported that a major malaria epidemic occurred in 1943 associated with *A. arabiensis* spread from Sudan along the Nile Valley. El Bahnasawy *et al.* (2011) in Toshka District detected *A. multicolor, A. sergentii,* and *A. algeriensis* intrroduced from the chloroquine resistant *P. falciparum* via the Egyptian-Sudanese borders. Wassim (2014) found that by ITS2-rDNA sequence *A. pharoensis* proved as the important vector allover Egypt, *A. sergenti* the primary vector in the Western Desert Oases and the Red Sea Coast, *A. multicolor* in Fayoum Governorate, and *A. superpictus* in Sinai Peninsula. Dahesh and Mostafa (2015) in Fayoum reported that 14/ 2044 (0.68%) travelers returned back from Sudan were *P. falciparum* (9), and *P. vivax* (5) passive cases. WHO (2015) reported from 2010-2013, Egypt successfully eliminated malaria, but remained in preventing the malaria re-introduction. Saleh *et al.* (2016) declared that imported malaria is a health problem that needed continuous monitoring. Kandeel *et al.* (2016) in 3 villages Aswan Governorate reported an outbreak of 20 *P. vivax* cases and one *P. falciparum* during May-June 2014, by house-to-house surveillance visits. They added that all laboratory positive infected patients were successfully treated.

Abdel-Motagaly *et al.* (2017) reported that the malaria needle-stick was nosocomial infection. Al-Agroudi *et al.* (2018) among one hundred UN Peace Keeping Forces back home, reported that malaria patients were 41 from Central Africa, 38, Darfur, 11 DR Congo, 3 Nigeria, 2 Chad and one case from to each of Rwanda, Djibouti, Yemen, Kenya, & Tanzania. The species were *P. falciparum* (83), *P. vivax* (10), *P. ovale* (one) and mixed infections (6). Mahmoud *et al*. (2019) collected *Anopheles* species from the malaria reported cases in Aswan for identification and detection of *Plasmodium* by PCR. A total of 38 *Anopheles mo*squitoes were collected and identified as *Anopheles multicolor* 70% (*A. multicolor*), *A. sergenti* 20% and *A. pharoensis* 10%. The latter showed 100% human blood preference compared to *A. sergenti* 20%) and *A. multicolor* (0%). All females

were 100% negative for *Plasmodium* DNA, and all blood films showed no parasite.

Elgohary and Ibrahim (2022) reported a male 35 years old Policeman on UN Peace Keeping Mission Forces returning back from Democratic Republic of the Congo, Kinshasa the Capital, who was in the Police Camp from 13th October, 2021 to 29th October 2022 when he returned back to Egypt with manifestations suggestive malaria. He didn't receive any chemoprophylaxis during his stay, and without any history of medical importance. Patient was presented to the ER with fever, malaise and headache for three days after confirmation. He underwent splenectomy and treatment with 1- Artesunate 2.5mg/kg twice for 1 day then once for 3 days. 2- Doxycycline 100mg oral twice daily. 3- Perfelgan vial three times daily. 4- Conterloc 40mg twice daily. 5- Dexamethasone 8mg once daily. 6- Meronam 1gm IV 3 times daily. 7- Clindamycin 6000mg IV three times daily. 8- Doxycycline restarted. 9- Platelets 12 units once. 10- Human albumin 3 times for 2 days. 11- Quinine Hcl 650mg over 4hr 3/day. 12- Solumedrol 1gm. 13- A unit packed RBCs. He was completely cured and discharged.

Conclusion

Malaria is an important cause of fever and serious illness in returned travelers. Meanwhile, malignant malaria must be differentated from other *Plasmodium* species and from zoonotic babesiosis transmitted by ticks reported in several European countries, as well as in Egypt, Sudan, and South Africa.

Risk assessment for malaria requires detailed review of the planned itinerary together with the recent CDC guidelines and advisories. Also, high-risk groups include travelers born in endemic malaria regions that relocate outside the endemic area but subsequently return to visit friends and relatives, pregnant women, and military personnel.

Travelers to malarias areas must be counseled regarding mosquito bite prevention and adherence to antimalarial chemoprophylaxis if indicated. However, they must understand that no chemoprophylaxis guarantees complete protection; fever during or after travel is a medical emergency requiring urgent medical attention. They must be instructed to avoid *Anopheles* mosquitoes' bites, including avoiding outdoor exposure between dusk and dawn, wearing clothing that reduces the exposed skin, wearing insect repellant (e.g., DEET or Picaridin), staying in well-screened or air-conditioned rooms, and sleeping within bed nets treated with insecticide (e.g., permethrin).

Recommendations

Consider malaria in the differential diagnosis of any traveler or immigrant came from malaria-endemic areas for ≤1 year.

The proper examination of back homed travelers as well as the newly arrived immigrants from known malaria endemic areas is a must in respect of they were symptomatic or without any suggestive symptoms.

No doubt, vector control is the main approach to prevent malaria and reduce local transmission. Malaria vector control requires periodic collection and interpretation of data on local vector species, potential invasion by vectors from other neighboring areas, their susceptibility to ecologically safe insecticides (larvae and adults) and vector and human behaviors.

The WHO Guidelines for malaria bring together all current WHO recommendations on malaria in one easy-to-navigate web-based platform. They are a living resource that will be updated periodically as new evidence becomes available in English, French, Spanish and Arabic.

Authors' interests: They declared that have neither competing interests, nor received any funds. Also, all equally shared in the review.

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