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Imported Malaria in Egypt

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ABSTRACT
Background: With the dramatic increase in international travel among Egyptian people, the risk of malaria importation from malaria-endemic regions threatens the achievement of the malaria elimination goal of Egypt.
Patients and methods: Blood samples from 700 patients were collected from different medical laboratories in Egypt from travelers to African endemic areas either Egyptians or foreigners coming to Egypt within previous 8 weeks; during period from January to December 2016. All samples were done by direct microscopic examination of the Giemsa-stained thick and thin blood smears ("gold standard"), as well as the rapid diagnostic test (RDT) (Accurate MAL-w23, Polymed) for feverish cases as a confirmatory test.
Results: A total of 25;3.57%(out of 700) imported malaria cases were recorded.*P. falciparum* (15 cases,60%) and *P. vivax* (14 cases, 56%) were the two predominant species as well as one case (4%)*P ovale.* From them 4 cases had mixed *P.falciparum* and *P.vivax* and one case had *P. falciparum* and *ovale*, The cases were coming from 11 African countries and their distribution was, Sudan,11; Nigeria, 5; Ghana,3; Cameroon,1; Angola,1; Congo,1; Chad,1; Guinea,1; Togo,1; South Africa,1; and Eritrea,1case. RDT was performed for feverish (300) patients and positive results were obtained among 27 cases. Twenty five of them had parasitemia while the other two had history of past infection.
Conclusions: Imported malaria infections pose an increasing challenge to the malaria elimination in Egypt. The risk of potential re-introduction of malaria into inland malaria free areas of Egypt should be urgently addressed, also the rapid diagnostic tests (RDTs), offer a useful tool for rapid diagnosis in suspected cases.
Keywords: Malaria, Imported, Epidemiology, Egypt, diagnosis.

INTRODUCTION

The international spread of infectious diseases including malignant malaria has been accelerated by increasing human mobility and travel over recent decades[1, 2, 3].

The importation from endemic regions and the threat of spreading drug resistance type remains a problem for many eliminating or malaria free countries due to the difficulty of diagnosis, substantial burden of treatment, relatively high mortality rates, and potential secondary local transmission[4, 5].

The disease is considered as one of the most important parasitic infections that affect mankind with a heavy burden where an estimated 3.3 billion people are at risk of being infected and developing disease[6].

In 2015, the World Health Organization (WHO) set a new target of reducing the global malaria burden by 90 % by 2030, and encouraged nation members to fulfill the goal of malariaelimination[7].

Clinical diagnosis of malaria based on patients' signs and symptoms, including fever, headache, weakness, myalgia, chills, dizziness, abdominal pain, diarrhea, nausea, vomiting, anorexia, and pruritus is nonspecific and provides variable results[8].Microscopic blood examination is recognized as the "gold standard" for definitive diagnosis, but requires experienced personnel and implementation of good quality control and assurance system[9].

Serological methods for diagnosis of parasitic antibodies as ELISA and indirect immunofluorescence (IFA) do not detect current infection but refer to past exposure[10]. However, they are useful when applied in epidemiological surveys for screening of potential blood donors and in providing evidence of recent infection in immunocompromised individuals[11], as well as among hidden malaria carriers.

Specific antigenic detection is considered a good diagnostic tool of malaria which can differentiate between *Plasmodium species*[12].Also the rapid diagnostic tests (RDTs), offer useful alternative tools of diagnosis. However, before these tests can be widely adopted, several issues remain to be addressed, including quality assurance of diagnostic performance and affordable cost when applied in field conditions.

Hence, the present study was done to evaluate the present situation of imported malaria in Egypt using (RDT) as well as microscopic examination.

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PATIENTS AND METHODS

Seven hundred blood samples were collected from different medical laboratories in Cairo from travelers to endemic African areas either Egyptians or foreigners coming to Egypt within previous eight weeks, in the period from January to December 2016.

The diagnosis of malaria was based on clinical manifestations, travel history and the positive results of microscopic examination of the Giemsa-stained thick and thin blood smears ("gold standard") [13] as well as the rapid diagnostic test (RDT) (Accurate MAL-w23,Polymed).which is one step rapid test using lateral flow chromatographic immunoassay for the simultaneous detection and differentiation of *Plasmodium* antigensin human blood or serum samples. The assay was performed according to the manufacturer instructions **(fig.1).**

RESULTS

Among the examined persons,200 of them were females (28.6%)and the other 500 were males (71.4%) **(Fig.2).**The average age was 33.6 years, ranging between 1 and 70 years **(Fig.3).**

The average time between the date of coming from malaria endemic area and the onset of symptoms was 16.5 days, ranging between 4 and 50 days and the average time between the onset of symptoms and the correct diagnosis was 6.6 days (4 to 20 days) **(Tab.1).** Past history of malaria was reported by 60 patients **(Fig.4)**with no data concerning malaria species. Only 300 cases had fever during sampling **(Fig.5).** *Plasmodium species* were identified in 25(3.57%) out of 700 individuals **(Fig.6)**, where 15 of them were diagnosed as *P. falciparum* and 14 had*P. vivax* while 1 was diagnosed as *P. ovale*. Among these patients 4 had mixed infection with *P. falciparum* and *P. vivax* andone case had mixed *P. falciparum* and *P. ovale* infection **(Fig.7).**Six patients gave past history of malaria **(Fig.8).**

The standard diagnostic method for diagnosis and differentiation of *Plasmodium* species was the microscopic examination of thick and thin blood films and the average parasitemia reached 1.16% (0.01 to 4%). RDT was performed for feverish(300) patients and positive results were obtained among 27 cases **(Fig.9).**

Twenty five of them had parasitemia while the other two had history of past infection **(Fig.10).**

The major species of imported malaria were *P. falciparum* and *P. vivax* coming from 11 African countries and their distribution was, Sudan,11; Nigeria,5;Ghana,3;Cameroon,1;Angola,1;Congo, 1;Chad,1;Guinea,1;Tog-o,1;South Africa,1; and ERITREA,1CASE.

FIGURES AND TABLES

Table 1

Time / Malaria	Average time per days
Symptoms appearance	16.5
Diagnosis after symptoms appearance	6.6

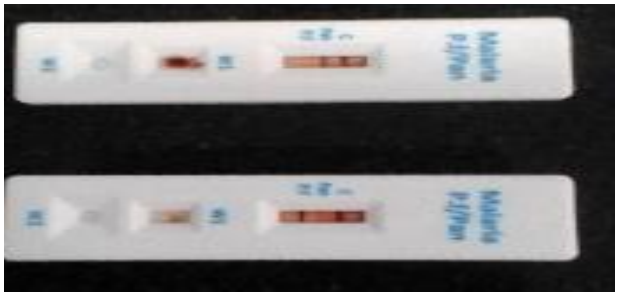
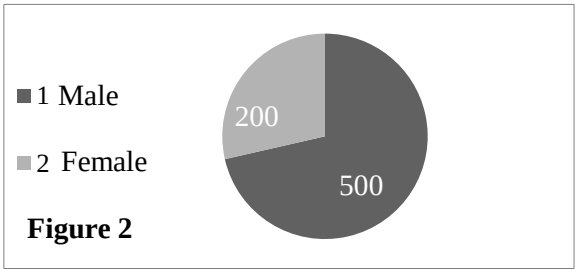


Figure 1



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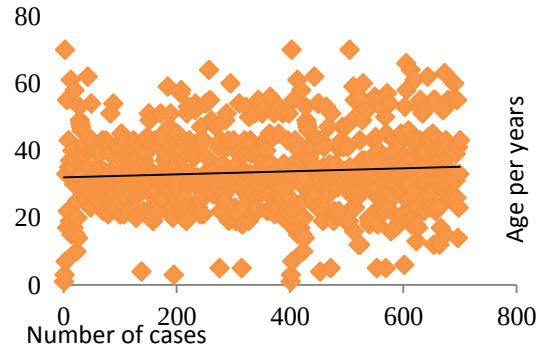

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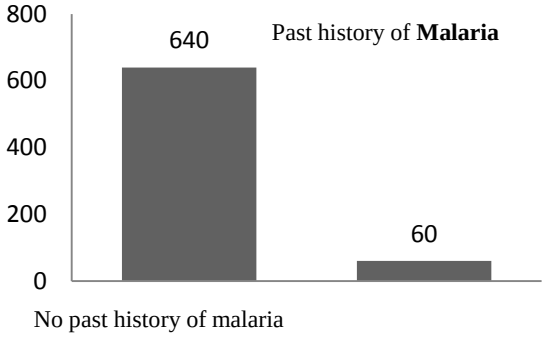

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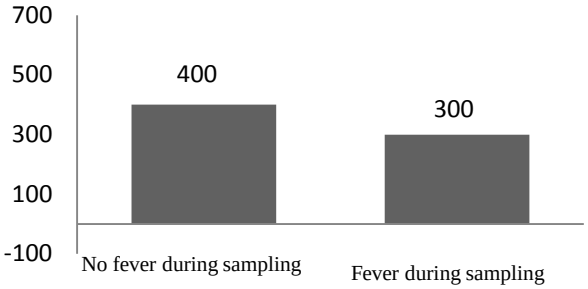

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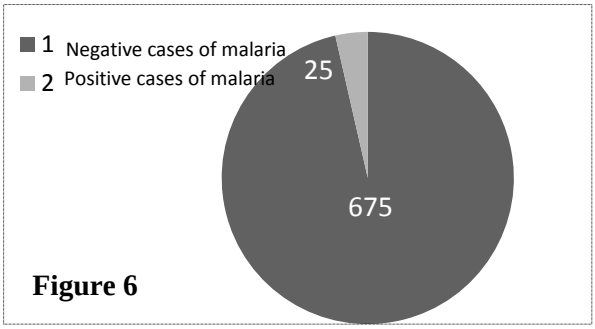

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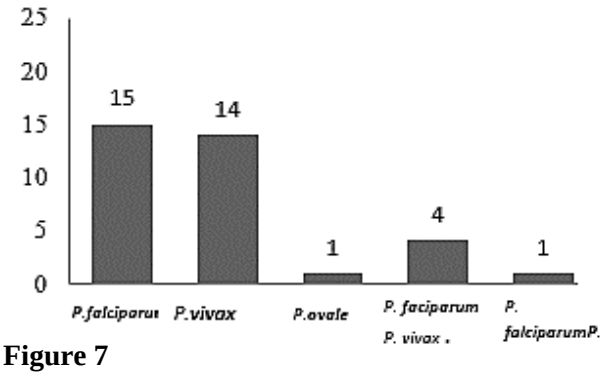


Figure 7

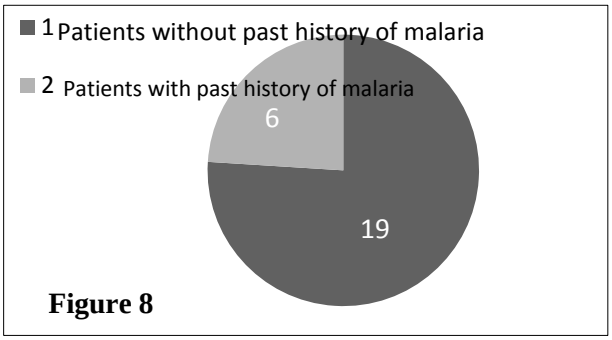
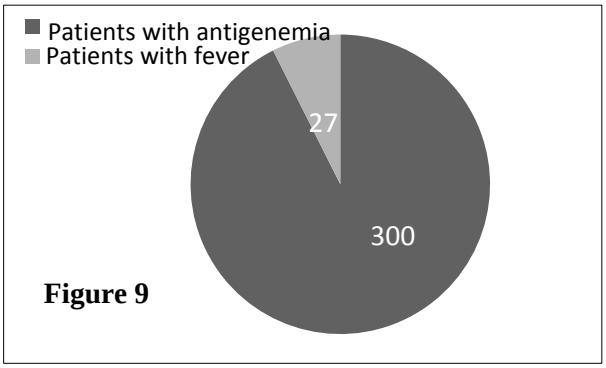


Figure 8



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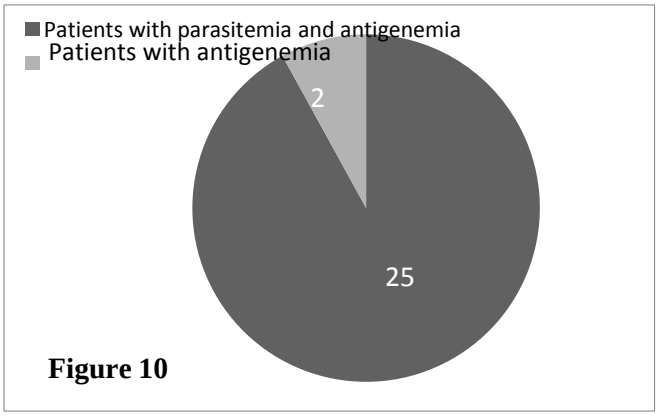

Figure 10

DISCUSSION

Due to lack of awareness of clinical manifestations and methods of diagnosis of malaria among private clinics and primary health care units due to low endemicity of malaria in Egypt. Also due to global economic integration and the rapid economic development of Egypt where large numbers of people travel to and come from malaria endemic countries for financial investment, commercial trade, labor, and tourism.So the aim of the present work was to threw light and evaluate the present situation of imported malaria in Egypt through examination of 700 blood samples of suspicious malaria infected people coming from endemic African countries using thick and thin blood film techniques as well as rapid diagnostic test as a confirmatory one.

In the present work it was found that , out of 700 malaria suspicious patients coming from endemic countries(either Egyptians or foreigners) only 25(3.57)were infected. Fever was a constant symptom in malaria positive cases and this in accordance with the universal screening symptoms for malaria in research studies[14].

All positive cases gave a history of travel to Sudan,11; Nigeria,5; Ghana,3; Cameroon,1; Angola,1; Congo,1; Chad, 1; Guinea, 1;Togo,1; South Africa,1;Eritrea,1.Most of them had a history of traveling to Sudan, which is considered as one of the highest endemic malaria burdens in Sub Saharan Africa[15]**.** Malaria endemicity varies from hypoendemic, through mesoendemic and hyperendemic, to holoendemic and the prevalence ranges from less than 1% to more than 40% and it is higher in rural areas than in urban ones[16]**.** In the present study, *P. falciparum* and *P. vivax* are the two major imported malaria species. The presence of two morepositive cases as detected by RDT means the presence of antigenemia without

parasitemia as the parasite particles can remain in the blood stream long after infection and therefore differentiating of active infection from a recently cleared infection is difficult[17]. In another study[18]there were two *Plasmodium falciparum* infections missed by microscopy and were detected by RDT probably due to low parasitemia in tested samples or drug intake that clears parasitemia with persistence of antigenemia. The relationship between the increased economic investment and numbers of exported Chinese laborers to Africa and the increased number of imported malaria cases has been established[19]. Epidemiological investigations of all imported malaria cases among Chinese were conducted [20] wherea total of 1420 cases were examined during the study period. *P. falciparum* (723 cases,50.9 %) and *P. vivax* (629 cases, 44.3 %) were the two predominant species. Among them, 81.8 % of cases were overseas laborers returned from 41 countries, mainly located in Africa (58.9 %) and Southeast Asia (39.4 %). In the present study, it was noticed that a large number of cases presenting with fever or history of fever did not have malaria.

CONCLUSIONS

This study shows that overseas infections of malaria have become a major threat to Egyptian travelers to African countries. In order to reduce the infection of malaria during periods abroad, awareness and effective protective measures against exposure to mosquito bites and malaria parasites among highrisk groups should be enhanced. The need to improve capacity for imported case detection to reduce burden of severe malaria disease and deaths, as well as prevent secondary malaria transmission within Egyptians.RDTs were found simple and effective for rapid diagnosis of malaria which might enforce the control measures in Egypt against imported malaria.

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