EPIDEMIOLOGY OF IMPORTED MALARIA CASES IN JORDAN BETWEEN 2000 AND 2005

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ABSTRACT

Objectives: To determine some epidemiological aspects of imported malaria cases among Jordanians and non-Jordanians who returned to Jordan from endemic areas and to highlight the importance of compliance with prophylaxis against this disease and identify the type of plasmodium species causing the disease.

Methods: This is a descriptive study of the imported malaria cases registered at Malaria and Bilharzia Division, Ministry of Health in Jordan. The study included all people registered and tested for malaria at Malaria Division between January 2000 and December 2005. All subjects gave a peripheral blood sample to detect malaria parasite by thick smear method.

Results: From 2000 to 2005, out of 304,314 blood smears, 808 had positive results (detection of malaria parasites) in their blood sample. Out of the total number of 808 cases 606 (75%) were infected with plasmodium vivax, 201 (24.9%) with plasmodium falciparum, one (0.1%) subject had mixed infection. There were no positive cases of plasmodium malarie in our study period. The geographic distributions of these imported cases were mainly from East Africa (Sudan and Eritrea) and South East Asia (Timor). Jordanian nationals constituted 589 (72.9%) cases and the majority of them were military personnel who participated in Peace Keeping Forces all over the world.

Conclusion: The continued presence of imported malaria in Jordan calls for emphasis on effective prophylaxis especially among Jordanian Peace Keeping Forces to prevent resurgence of this disease and to keep Jordan at a low incidence of malaria.

Key words: Epidemiology, Imported, Malaria

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Introduction

Four species of the protozoan parasite plasmodium infect humans. P. falciparum can cause a lethal infection, whereas P. vivax, P. malariae, and P. ovale cause milder but nonetheless debilitating acute disease. P. vivax and P. falciparum are the most abundant species; P. ovale is the rarest.[(1)] Beside the clinical suspicion of malaria, the diagnosis is made via microscopic examination of thick and thin blood smears. The thick blood smear is more sensitive in detecting malaria parasites because the blood is more concentrated allowing for a greater volume of blood to be examined. However, thick smears are more difficult to read. Laboratories that have limited experience may prefer to use thin smear, which can aid in parasitic species identification.[(2)]

While primary malaria transmission was successfully interrupted in many countries including Jordan, malaria (falciparum and vivax) remains a constant health threat for travelers to other

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Table I. No. of positive samples, species of P. Malaria (2000-2005)

Year	No. of Samples	No. of Positive Samples	Type of Plasmodium		
			P.Falciparum	P.Vivax	Mixed
2000	55279	148	42	105	1
2001	59235	131	50	81	0
2002	57700	143	31	112	0
2003	54658	144	26	118	0
2004	47363	160	41	119	0
2005	30079	82	11	71	0
Total	304314	808	201	606	1
Percentage			24.9	75.0	0.1

Table II. Imported Malaria Cases by Age Group (2000-2005)

Age Group/Years	Year						Total	
	2000	2001	2002	2003	2004	2005	Number	Percent
16 - 25	44	36	32	41	39	23	215	26.6
26 - 35	79	69	80	78	101	40	447	55.3
36 - 45	22	19	26	20	16	17	120	14.9
More than 45	3	7	5	5	4	2	26	3.2
Total	148	131	143	144	160	82	808	

malarious areas. These travelers may become symptomatic during their stay in these localities or after they return to their home country.[3] The risk of malaria infection to travelers is increasing; each year 25-30 million people from non-tropical countries visit areas in which malaria is endemic, of whom between 10,000 to 30,000 contact the disease.[4] As many Jordanians are visiting endemic malarious areas, it is certainly worthwhile to screen for this disease among them to avoid unnecessary complications caused by missing the correct diagnosis.

Methods

Malaria and Bilharzia Division is responsible for planning and implementation of malaria control programme, strategies and activities including control of the mosquito vector, detection and treatment of imported malaria cases and all other cases (like introduce or injected). The Malaria and Bilharzia Division has maintained continuous surveillance of Plasmodium infections among arrivals utilizing their teams at border entry stations of the country. All entering subjects underwent a thick blood smear test after verbal consent regarding previous malaria infection, the endemic area they arrived from, and their residency address to follow them up, for treating them if they were infected.

A retrospective review over a period of 6 years, from January 2000 to December 2005 was done, during which all imported malaria cases were followed closely with early diagnosis, proper treatment and followed up by monthly visits to the Malaria and Bilharzia Division for at least one year duration.

Results

During the study period a total of 304,314 blood samples were taken from individuals arriving in Jordan from endemic areas. Eight hundred and eight cases of imported malaria were identified. Out of this number, a total of 201 (24.9%) cases were caused by P. falciparum, 606 (75%) by P. vivax, one (0.1%) case by mixed malaria infection. There was no reported case of P. malarie in our study period (see Table I).

There were 775 (95.9%) males and 33 (4.1%) females with a mean age of 30.4 ± 8.1 (range, 16 – 58) years as shown in Tables II.

Table III shows the geographic distribution of imported cases, from a total number of 808 positive samples: 72 (8.9%)cases were from West Africa , 340(42.1%)cases from East Africa, 84(10.4%) cases from Central Africa, 1(0.1%)cases from South Africa, 3 (0.4%) cases from North Africa, 67(8.3%) cases from south Asia,153(18.9%) cases from South East Asia,47(5.8%) cases from Middle East, 2 (0.2%) cases from the Caribbean and 39 (4.8%) cases had no available data for their source. There were no documented cases from North Asia, East Asia and Central\South America.

As shown in Table IV, Jordanians constitute 72.9% (n=589) and 27.1% (n=219) were non-Jordanians. The majority of Jordanians were participants in

Table III. Imported Malaria Cases by Travel Area#

Geographic area *	Year						Total	
	2000	2001	2002	2003	2004	2005	Number	Percent
West Africa	12	27	2	8	15	8	72	8.9
East Africa	…	11	73	94	104	58	340	42.1
Central Africa	22	16	18	6	17	5	84	10.4
South Africa	…	1	…	…	…	…	1	0.1
North Africa	2	…	1	…	…	…	3	0.4
South Asia	14	13	8	12	15	5	67	8.3
South East Asia	77	43	25	8	…	…	153	18.9
Middle East	17	9	9	7	3	2	47	5.8
Caribbean	…	…	…	…	…	2	2	0.2
Not given	4	11	7	9	6	2	39	4.8
Total	148	131	143	144	160	82	808	100 **

#According to Centers for Disease Control and Prevention, Department of Health and Human Services division areas
*There are no documented cases from North Asia and Central / South America
**Totals do not add to 100%

Table IV. Imported Cases by Nationality

Year	Total cases	Jordanian		Non-Jordanian	
		Cases	Percent	Cases	Percent
2000	148	92	62.2	56	37.8
2001	131	95	72.5	36	27.5
2002	143	106	74.1	37	25.9
2003	144	107	74.3	37	25.7
2004	160	121	75.6	39	24.4
2005	82	68	82.9	14	17.1
Total	808	589	72.9	219	27.1

United Nations (UN) Peace Keeping Missions and the majority of the non-Jordanians were from Sudan, Yemen, Sri Lanka and Pakistan.

Out of the 75% of cases which were caused by P. vivax, the majority originated from South Asia (India, Pakistan, and Sri Lanka) and Central Africa (Sudan). Sudan was a major source of malaria imported from Central Africa in this study: 74 cases were imported from there, 62 patients were Sudanese and 12 patients were Jordanians. P.falciparum constituted 24.9% of recorded cases; most of them were from East and West Africa.

Out of 808 cases, 500 (61.95%) cases were from Africa, from which, there were 340 cases from East Africa with the vast majority (n=336) from Eritrea, all of them were Jordanians who participated in UN Peace Keeping missions.

The majority of cases reported from West Africa were from Sierra Leone with 34 cases out of 72 (47.2%), and also all of them were Jordanians who participated in the UN Peace Keeping missions.

In our study, 0.1% (n=1) of cases was caused by mixed malaria infection, this patient showed P. falciparum and P. vivax in his blood smear. P. malariae was not diagnosed in our study period, but had been identified in prior years 1997, 1998 and 1999 with number of 2, 1, 1 cases respectively. P. ovale was not isolated at Ministry of Health over the study period.

South East Asia contributed 18.9% (n=153) of malaria cases, with around 95% (n=146) of cases were from Timor. All patients from Timor were Jordanians who participated in UN Peace Keeping missions.

Discussion

Despite 50 years of eradication efforts, malaria remains a major scourge throughout the tropics. The disease is becoming increasingly common, with 300 million to 500 million new infections and 1.5 to 2.7 million deaths, mainly children, occurring every year.[2,3] The geographic distribution of malaria depends mainly on climatic factors such as temperature, humidity, and rainfall. In warm regions close to the equator transmission is more intense, occurs around the year and is predominantly with P. falciparum, while in cooler regions, transmission is less intense and more seasonal and P. vivax prevails because it is more tolerant of lower ambient temperatures.[5] At least 90 countries in Africa, Asia, the Caribbean, Central and South America are officially considered malarious.[6] Ninety percent of

malaria cases and deaths are believed to occur in sub-Saharan Africa, and in many areas the disease is spreading through the local population and also to travelers. In west Africa, without prophylaxis, malaria is estimated to have an incidence of 1.4% per person per month and travelers to west or east Africa have the chance to contract the disease by 2-4% per month due to lack of partial immunity that is achieved by previous attacks of malaria.[7,8] The risk that a traveler will become infected depends on the overall rate of malaria transmission in the area visited and the extent of the traveler's contact with infected mosquitoes. Transmission rates may vary greatly from region to region even within the same country, thus, the route and mode of travel and destination are important considerations. Furthermore, since the rate of transmission of malaria may vary from season to season in the same region, the timing of travel may also influence the risk. Finally, since female anopheline mosquitoes feed from dusk to dawn, the risk is influenced by a traveler's nighttime activities and the characteristics of his or her lodging.[1]

The spread of drug-resistant strains of P. falciparum since the 1960s has reduced the efficacy of chloroquine, which for several decades was a highly effective, convenient, and relatively safe prophylactic and therapeutic drug. The combination of pyrimethamine and sulfadoxine and amodiaquine were introduced as alternative chemoprophylactic agents, but both proved to be too toxic to be widely recommended for this purpose. Subsequently, mefloquine became available as an effective chemoprophylactic drug against chloroquine-resistant P. falciparum. Doxycycline also proved useful for this purpose.[1, 9-11]

No currently available regimen of chemoprophylaxis against malaria is completely effective, and drug resistance continues to evolve. The potential for serious toxicity with these anti-malarial agents is perhaps the greatest concern and necessitates a careful review of travel plans to assess risk versus benefit. Even minor side effects adversely affect compliance, and many vulnerable travelers never complete their recommended prophylactic regimen.[12] accordingly careful attentions to avoid contact with mosquitoes are an additional and essential facet of malaria prevention.

While malaria transmission was successfully interrupted in the United States (US) during the late 1940s, malaria remains a constant health threat for US travelers to malarious areas. In 2004, 1324 cases of malaria were reported in the USA, P. falciparum identified in 50% of them. Seven hundred and seventy five cases out of 1324 occurred in civilians, all of which were imported, 65% of them did not take any chemoprophylaxis and only 20% were compliant with the regimen recommended by the Center for Disease Control and Prevention (CDC) for the area in which they traveled. Eighty-eight percent of patients with imported malaria reported symptom onset after arriving back in the USA and 73% of imported cases occurred in persons who traveled to Africa.[2,13]

In a retrospective study done by Brustenga for the years 2002 to 2004 in Spain showed that P. falciparum is the most diagnosed species and Africa is the continent from which most cases are imported.[14] In another retrospective study, done by Ong and Smyth for imported malaria cases in Northern Ireland between the years 1998 and 2003 showed that P. falciparum was the most common infection (60%). This was particularly associated with travel to West Africa. Most cases were associated with short visits to malarious areas. Thirty-three percent of cases did not take prophylaxis and of those that did, approximately half were taking a prophylactic regimen appropriate to the region visited.[15]

Sudan is one of the unusual regions in Africa where all four plasmodium species are found, with the frequency of the species varying according to different studies and to epidemiological zones of the country,[16] malaria is considered a leading cause of morbidity and mortality in Sudan, and the entire population is at risk of malaria, although to different degrees. In northern, eastern and western states of the Sudan malaria is mainly low to moderate with predominantly seasonal transmission and epidemic outbreaks. In southern Sudan, malaria is moderate to high or highly intense, generally with perennial transmission.[17] In a retrospective study done by Alkhalife of imported malaria infection diagnosed at the Malaria Referral Laboratory in Riyadh, Saudi Arabia, showed that although P. falciparum counted for about 90% of cases coming from Sudan, there was a high proportion of infection caused by P. vivax.[18]

Two studies conducted in Sierra Leone in 1992 and 1994 showed that cases caused by P. falciparum constituted 61% and 90.4% respectively.[19] In two retrospective studies done in Sierra Leone, of Jordanian medical teams participating in UN missions in the years 2000 and 2002 showed that

despite emphasized compliance with mefloquine prophylaxis among the members of the missions, 5% (38 malaria cases among 760 participants) and 15.1% (18 malaria cases among 119 participants) of malaria were reported respectively. This failure rate of chemoprophylaxis may be explained either as patient's non-compliance or the presence of a Mefloquine-resistant strains.[7,20]

In Eritrea, malaria is spread over 75% of the surface of the country,[21] and according to Masale *et al.* malaria affects two thirds of the population with P. falciparum predominating at 90% and P. vivax at 10%.[22]

The vast majority of cases in our study from South East Asia were from Timor, which has a very high risk for malaria all over its regions,[23] and the majority of patients from South Asia were Pakistanis, Indians and Sri Lankans with a predominance of P. vivax species which is expected because it is the predominant species of malaria in their respective home countries.[24-26]

In the United Kingdom, there are 1500-2000 imported cases reported each year, and 10-20 deaths. Three-quarters of reported malaria cases are caused by P. falciparum, others caused by P. vivax, a few cases are caused by P. ovale and P. malariae, although mixed infections with more than one species of parasite can occur.[27]

Conclusions

Malaria with its different species is being imported to Jordan by Jordanians participating in peace keeping missions in different parts of the world, mainly Africa and Asia and by non Jordanians visiting Jordan for work or tourism. Caution must be exerted to avoid the reintroduction of this deadly disease which was eradicated in Jordan many years ago.

The participants in peace keeping missions must be properly educated about the seriousness of the issue of taking prophylactic medications. It is also important to remember the role of antimosquito measures in preventing the disease. The possibility of importation of malarious mosquitoes on aircraft coming from endemic areas should also be remembered.

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