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Malarial Parasite Screening
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MALARIAL PARASITE SCREENING OF TROOPS RETURNING FROM UNITED NATIONS MISSIONS TO PAKISTAN

Muhammad Qaiser Alam Khan, Nasira Shaheen, Romesa Qaiser Khan

Combined Military Hospital Kharian/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To establish efficacy of malaria prevention programs by screening troops returning from United Nations peace-keeping services in high risk areas in Africa for malarial parasites.
Study Design: Quantitative analysis.
Place of Study of Study: Combined Military Hospital, Kharian, from Jan 2017 to Jan 2019.
Methodology: In this cross sectional study, individuals of regiments returning to Pakistan from high risk areas in Africa were screened for malarial parasites. A total of 1632 samples were analyzed during this time frame. Informed consent was taken at the individual and institutional level. Blood samples obtained from each participant were tested by both immuno-chromatographic techniques and peripheral blood films.
Results: Total 1632 individuals were screened for malarial parasites. Peripheral blood slides were negative in all individuals except one. Immuno-chromatographic techniques for detection of malarial parasites were positive in 17 individuals for *Plasmodium falciparum* antigen. Only one individual had both *Plasmodium vivax* and *Plasmodium falciparum* positivity via both methods. All of them were asymptomatic at the time of screening, had a past history of high grade fever treated with anti-malarial drugs and were admitted for observation and follow up.
Conclusion: Despite the high prevalence of malaria in Africa, the current prevention protocols prove to be highly efficacious in protecting United Nations peace-keeping forces from infection and lowering mortality rates.

Keywords: Anti-malarial drugs, Malaria, Peacekeeping forces, Screening.

INTRODUCTION

Malaria is a mosquito borne infection caused by the parasitic protozoa belonging to *Plasmodium* type. A variety of *Plasmodium* species can infect humans and perpetuate the malaria cycle. Most malaria-related deaths are attributed to *P. falciparum* infection, as *P. vivax, P. ovale* and *P. malariae* generally cause milder forms of the disease. The species *P. knowlesi* rarely causes disease in humans.

The disease is widespread in tropical and subtropical areas forming a central belt around the equator. Due to the high level of morbidity and mortality caused by malaria, especially due to *P. falciparum* species, it has placed the greatest selective pressure on the human genome, which has led to protective mutations as remote events[1]. Several genetic factors provide some resistance to it including sickle cell trait, thalassemia trait, G6PD deficiency and the absence of Duffy antigens on the red blood cells.

According to WHO, the probable disease burden in Pakistan as of 2018 due to malaria is roughly 3.5 million cases, with peak transmission occurring in the post-monsoon season from August to November[2]. A number of strategies are in place to combat this ever-growing health concern. Free testing for malaria is available at all government facilities as well as artemisinin-based combination therapy (ACT) for positive cases. There is an annual distribution of ITN and LLin (insecticide treated bed nets and long lasting insecticidal nets respectively) free of cost. Public awareness campaigns last throughout the year. But the presence of poverty, inefficient health systems and poor quality of life continue to perpetuate the cycle in regions where it is already a chronic problem[3]. As long as the disease remains endemic in certain regions, global health remains at risk, since even Malaria-free countries can import ca-

Correspondence: Dr Nasira Shaheen, Department of Pathology, Combined Military Hospital, Kharian Pakistan
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ses from travelers. In 2012, there was an reported increase in the number of imported Pakistani malaria cases in Germany from 0-32[4]. A 2015 study done in Jordan showed that 28.9% of the imported cases of *P.vivax malaria* came from Pakistani travelers[5].

Diagnostic criteria for malaria are based on initial screening via microscopic examination of blood films, which is the gold standard for parasite visualization. Confirmatory tests are carried out using antigen based rapid diagnostic tests[6]. PCR for malaria detection has been developed but is not used widely due to its complexity and cost[7]. Disease prevention is centered on reducing the incidence of mosquito bites through the use of mosquito nets and insect repellents, or by insect control measures such as sprayings insecticides and draining stagnant bodies of water[8].

Different drug regimens are available for malaria prophylaxis in high risktravelers to endemic areas[9]. Despite the high disease burden, no effective vaccine exists, although efforts to develop one are ongoing. Resistance among the parasites has developed to several anti-malarial medications, for example, chloroquine resistant *P. falciparum*, has spread to most malarial areas, and resistance to Artemisinin has become a problem in some parts of South Asia[10].

Given these ground realities, it is important to prevent cross transmission from visitors returning from abroad to those already at risk in Pakistan given the massive numbers of people susceptible to malaria in the country.

METHODOLOGY

This study was carried out at Combined Military Hospital, Kharian, from January 2017 to January 2019. All units returning from United Nations Missions from Congo and Sudan were screened upon return. No individual was excluded. The total sample size was 1632, and purposive sampling was used to identify the target population. A complete medical history was taken from each patient, physical fitness examination carried out and venous blood samples collected for immunochromatography (ICT) and microscopic testing. Malarial parasites were positively identified by microscopy on peripheral blood films and confirmed by antigen based rapid diagnostic tests (RTD). The total positives and negatives on test results were tabulated, analyzed using SPSS-23 software and plotted for comparison against statistics from other countries referenced from relevant studies. The total prevalence of malaria in our sample population was calculated by using the following formula:

Prevalence = Cases positive on ICT/Total number of people screened

RESULTS

Out of 1632 personnel, initial microscopic examination was negative for all cases except one. ICT malaria was positive in 17 cases showing *P. falciparum* infection. However, only one case was positive for mixed *P. falciparum* and *P. vivax* infection on both microscopy and ICT. Positivity on immunochromatography was taken as a definite positive, bringing the confirmed malaria cases in our study to 17. Malaria prevalence in our sample population was calculated to be 1.04% (17/1632 x100)

All positive cases were admitted for observation in the hospital. All positive cases were asymptomatic, had a history of fever before coming to Pakistan and had received anti-malarial treatment within one week of departure. Their hematological parameters and other biochemical tests were within normal limits.

Table-I: Results of malarial parasite screening.

Total Number of Troops Screened	n=1,632 (%)
Negative microscopy and ICT	1,613 (98.83)
Positive microscopy only	1 (0.06)
Positive ICT only	17 (1.04)
Positive microscopy and ICT	1 (0.06)

Table-II: Comparison of prevalence of malaria in studies on peacekeeping forces.

Author, Country	Number of positive cases / total population screened
This study, Pakistan	19/1632 (1.16%)
Chang E-A, Korea[12]	23/210 (10.9%)
Mayet A, France[13]	39/575 (6.78%)
Zhu, China[14]	829/4114 (20.15%)

When compared with studies from other countries, Pakistan showed the lowest rate of malaria prevalence in returning troops. Whether this low prevalence is attributable to sound prophylaxis or better innate immunity in our population, requires further investigation.

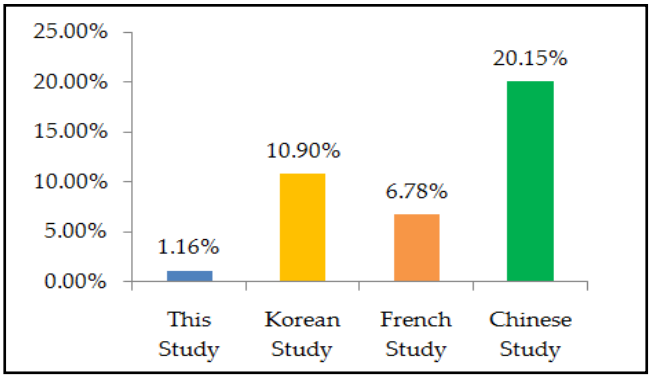

Figure: Bar graph showing comparison of malaria cases with other studies.

DISCUSSION

Many countries where peacekeeping forces are deployed are the most vulnerable to malaria, including South Sudan, The democratic Republic of Congo and Central Africa. This vulnerability is exacerbated by mass population displacements and damage to the health system as a result of conflict. Peacekeepers in endemic areas are at increased risk of exposure to local mosquito species, making them both potential victims of malaria and vectors for its transmission. In countries with a low burden of malarial disease, returning United Nations peacekeepers are the largest single risk group. An example is Sri Lanka, which reported upwards of 95 cases of malaria in 2016, despite being malaria free previously. All cases were imported in to the country from peacekeeping missions[14].

Peace keepers may potentially import drug resistant malaria into previously sensitized regions[15]. Numerous studies indicate the difficulties of protecting troops from malaria, indicating that it is nearly impossible to reliably prevent peacekeeping forces from exposure that could lead to acquisition or transmission of the infection[16]. In 2001, a Korean peacekeeping mission reported 23 positive cases from a total of 210 soldiers returning from Timor despite prophylactic and post exposure treatment[11]. These cases were attributed to an inappropriate use of personal protective measures and deployment at the time of peak malarial season. A French Army unit presented with 39 cases of malaria amongst those returning from Ivory Coast in 2006[12]. Thirty cases included three serious forms, occurring after returning to France and almost half of these cases stopped post-return chemoprophylaxis early. A larger scale study in China found 829 cases of malaria out of a total of 4114 cases tested with optimum adherence to treatment protocols[17].

In addition, there may be concerns of drug tolerability. A study done on Australian peacekeepers stationed in Timor showed that 6.5% of them stopped using mefloquine due to adverse effects, including three cases of serious neuropsychiatric effects[18].

Conversely, little data is available from Pakistan on the chemoprophylaxis provided to soldiers, the rate of imported cases, and the efficacy of our treatment protocols. Studies on malaria in Pakistan are centered at large on Afghani refugee settlements[19] or the northern areas[20]. The reporting of preventive measures taken against malaria is disproportionately negative as it focuses on remote centers rather than urban ones[21].

Therefore, our study serves as an introductory work and shows that the incidence of malaria in our troops deployed as United Nations peacekeepers in Africa is on the decline and efforts are largely successful in curtailing malaria with minimum morbidity and no mortality[22]. Moreover, a preventive approach is curtailing the introduction of resistant malaria to drug sensitive regions[23]. A British study done in 2015 on 512 soldiers stationed at a high risk area, reported that no cases develop if the chain of command is proactive about the implementation of malaria prevention policies[24].

CONCLUSION

Malaria chemoprophylaxis, which is issued free of charge to travelers, remains the most im-

portant strategy for preventing malaria in security forces personnel. Soldiers should continue to take the United Nations recommended prophylaxis and other preventable measures during their deployment as resistance to first line antimalarial drugs is prevalent in many African countries. At present, measures to prevent importation of malaria by peacekeeping personnel travelling abroad are very satisfactory in most aspects. Soldiers are well conversant about the chemoprophylaxis and preventive measures regarding malaria and HIV, and adhere rigorously to the established guidelines. A stringent screening and diagnostic system are in place, and the chain of command is cognizant of risk-reduction strategies these include education and awareness of the need of chemoprophylaxis, ensuring compliance with prophylaxis, and screening upon reentry into the country.

However some factors need to be emphasized and addressed, such as the need to continue chemoprophylaxis following return to the home country and follow up for malaria for 3-6 months after return before the prevention program can be hailed as an unequivocal success.

We recommend the administration of chemoprophylaxis to be done on a fixed day and under the direct supervision of medical personnel and records to be maintained in a register with nominal roll in future. These measures will not only ensure a continued standard of care for deployed forces but also give us access to a public health directory of preventive measures against a prevalent disease, which can then be refined and reapplied to other common diseases of concern in our society at large. In addition, a history of contact for those who do test positive can play a vital role in preventing transmission to civilian population at large. In the long term, reducing the prevalence of malaria in even one subset of the population will contribute greatly towards making Pakistan malaria-free.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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