



Seroprevalence of sandfly fever virus infection in military personnel on the western border of Iran



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Received 17 November 2015; received in revised form 22 January 2016; accepted 20 February 2016

KEYWORDS

Sandfly fever;
Virus;
Past infection;
Military personnel

Summary Military troops deployed to endemic areas are at risk of contracting sandfly fever, an arthropod-borne viral infection. Although typically a self-limited disease, sandfly fever can cause significant morbidity and loss of function among soldiers. We conducted this study to determine the extent of past SFV infection in a group of healthy Iranian military personnel in Ilam province on the western border of Iran. A total of 201 serum samples were tested by indirect immunofluorescence assay (IFA) to detect four common sandfly fever virus serotypes. Demographic data were also collected. Overall, 37 samples (18.4%) were positive for specific IgG antibodies to sandfly viruses. Sandfly fever Sicilian virus (SFSV) and sandfly fever Naples virus (SFNV) were the most common serotypes. A positive test was inversely related to nativity ($P < 0.01$) but was not associated with age ($P = 0.163$), duration of presence in the border region ($P = 0.08$) or employment status ($P = 0.179$).

Our findings indicate that past SFV infection is common among military personnel in the western border region of Iran, a Leishmania-endemic region. Therefore, it should be considered in the differential diagnosis of troops presenting with acute febrile illness in similar settings.

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Introduction

Sandfly fever, also called phlebotomus fever, three-day fever or Pappataci fever, is an acute mosquito-borne infection caused by phleboviruses (family Bunyaviridae). The virus is transmitted to humans by the bite of infected female phlebotomine sandflies, which are also the vectors of the protozoan parasite *Leishmania* [1]. Although the phlebovirus genus comprises over 60 antigenically distinct serotypes, only eight serotypes are known to cause disease in humans. The four most common serotypes associated with human infections include sandfly fever Sicilian virus (SFSV), sandfly fever Naples virus (SFNV), sandfly fever Cyprus virus (SFCV), and Toscana virus (TOSV) [2].

Clinical disease usually presents as an acute febrile illness that lasts 3 to 5 days, characterized by fever, myalgia and headache. In most cases, a disease follows a self-limiting course [3]. TOSV is the only serotype that has been associated with acute meningitis and encephalitis [4].

Sandfly fever virus (SFV) infections have been reported from endemic regions of certain Mediterranean and Middle Eastern countries; Phleboviruses appear to be responsible for many outbreaks of febrile illness among susceptible groups in these areas [5–10]. As most native adults in endemic regions are immune, there are few reports of clinical cases among indigenous people [2]; therefore, many studies have focused on SFV infection in high risk groups such as travelers to endemic areas and armed forces [11–13]. The disease is of particular importance to the military and was first described during World War II when nonimmune soldiers entered Mediterranean regions [2,5].

Leishmaniasis is endemic in different parts of Iran. Sandflies are vectors of both leishmaniasis and sandfly fever viruses. Therefore, it is assumed that SFVs are present in *Leishmania*-endemic areas of the country. The only published study pertaining to SFV infection in Iran was published more than 35 years ago when Saidi et al. [14] assessed the prevalence of SFV infection in Isfahan province, a well-known endemic area of zoonotic cutaneous leishmaniasis in central Iran [14,15].

The aim of this study was to assess the extent of past SFV infection in a group of military personnel in Mehran, a small city on the western border of Iran, which is also an endemic area of zoonotic cutaneous leishmaniasis.

Materials and methods

This cross-sectional study was conducted in Ilam, a province of Iran, to assess the seroepidemiology

of sandfly fever in troops serving in the border area during the autumn of 2013. The population of the study consisted of all military forces deployed along the western border of Mehran, Ilam province. Inclusion criteria included being a member of the armed forces (conscripted or staff) and having been in the area for at least 1 year, including a summer season (the period of intense sandfly activity). Voluntary informed consent was required for participation in the study. Demographic data including age, place of birth, employment status and duration of presence in the border region were collected and blood samples were taken by trained technicians.

Indirect fluorescent antibody test (IFA) was used to detect specific immunoglobulin G (IgG) antibodies to four common strains of the virus (SFSV, SFNV, SFCV and TOSV) in serum samples. Using the mosaic IgG SFV kits enables us to recognize all 4 serotypes of the virus. The laboratory kits were commercially available from EUROIMMUN, a German company.

The test was conducted as follows: first, cells infected with sandfly fever virus were incubated with the patient's diluted sera. In the case of a positive reaction, specific IgG antibodies bind to the antigens. Next, the antibodies attached to the antigens in the previous stage were stained by a fluorescein antibody (fluorescein-labeled anti-human antibodies); they would be visible under a fluorescent microscope. According to the manufacturer's instructions, a positive IFA test indicates previous (past) or acute infection with SFV.

Data were statistically analyzed using SPSS software; descriptive statistics, *t*-test and chi square test were performed.

Results

We visited all military posts along Mehran's western border with Iraq. Approximately 220 military personnel were eligible to participate in the study, of which 201 agreed to take part. Overall, 58% of the troops were indigenous people living in Ilam province. The mean age of participants was 24 years (SD: 5.5) with a range from 19 to 46 years. Military personnel included 56 (27.9%) staff officers and 145 (72.1%) conscripted soldiers. Deployment duration ranged from 12 to 156 months, with a mean of 18 months (SD: 21.1) (Table 1).

Among 201 samples tested, 37 (18.4%) sera were found positive for phlebovirus-specific antibody by indirect immunofluorescence assay. The most common serotype was SFSV (10.9%), followed by SFNV (5%), SFCV (1.5%) and TOSV (1%) (Table 2).

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