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Review

Global status of visceral leishmanial infection among blood donors: A systematic review and meta-analysis

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ABSTRACT

Introduction: Transmission of *Leishmania* through transfusion has been reported from various Visceral leishmaniasis (VL) endemic areas of the world. The true burden of *Leishmania* infection in blood donors remains generally unknown. Thus, the present systematic review attempted to determine the global prevalence of *Leishmania* infection among blood donors.
Methods: Data were extracted through five English and five Persian databases during the period from 1997 to 2016. Overall, 16 articles fulfilled the inclusion criteria and were used for data extraction in this systematic review.
Results: In total, 13,743 blood donors from different regions of world were examined. The prevalence rate of *Leishmania* infection according to seropositivity obtained 7% (95%CI: 5%, 8%). The lowest and the highest prevalence were related to Bangladesh 0.25% (95%CI: 0.0%, 1.0%) and Brazil, 16% (95%CI: 12%, 19%). Seroprevalence rate of leishmaniasis among females was more (4.60%) than males. Of 15 studies included in the meta-analysis, the pooled prevalence rate of molecular tests was obtained 2% (95%CI: 1%, 3%) in which Iran and Spain had the lowest and the highest prevalence, 0.05% and 7%, respectively. Our analysis showed that *L. infantum* was more common than *L. donovani* as etiological agent of VL among all donors.
Conclusion: Our data confirms the presence of asymptomatic carriers of VL in endemic areas and supplies as an attentive to the likelihood of these carriers acting as blood donors. Moreover, we conclude that molecular tests for screening in asymptomatic blood donor provide an accurate estimate of the rate of infection over serological tests.

Contents

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1. Introduction

Visceral leishmaniasis (VL), also known as kala-azar, is considered as one of the most important neglected vector-borne zoonotic parasitic disease with the high mortality rate if left untreated. Sand fly is the vector though man and carnivores is the typical reservoir. In the human host, parasites are surrounded by macrophages, which are then carried by the circulation system to other organs like liver, spleen and bone marrow where they cause hyperplasia of monocyte and or macrophage cells [1]. WHO estimates that the disease is endemic at least in 60 countries of four continents with 0.5 million new cases and about 40,000 cases death annually [2]. VL is caused by *Leishmania donovani* complex including *Leishmania infantum (L. infantum*) and *Leishmania donovani* (*L. donovani*). In general, *L. infantum* infections are asymptomatic, raising concern that the parasite could be available in blood donors from else healthy inhabitants in regions to which it is endemic [3]. The transmission of parasites through transfusion is relatively rare. Currently six parasitic infections have yet considered as transfusion-transmitted infections (TTI) including *Plasmodium spp*., *Trypanosoma cruzi*, *Leishmania* spp., *Babesia microti*, *Toxoplasma gondii* and Filaria [4].

Despite the high incidence of leishmanial infection among blood donors, there are limited published reports of the transfusion-transmitted leishmaniasis (TTL) and only 14 cases of it have been reported from various VL endemic areas in the literature up to now [5–9]. Blood donors in VL endemic regions are the healthy individual who may have *Leishmania* infection without having apparent symptoms or signs. These asymptomatic infected subjects may transmit leishmaniasis to susceptible recipients through transfusion. Several numbers of blood transfusion recipients are patients suffering from cancer, recipients of hemodialysis and organ transplants, infants, and patients with hemoglobinopathy disorders [4,5,10,11]. These individuals are at risk of obtaining VL through transfusion due to their immunosuppression status. The danger for VL transmission toward blood transfusion speaks to a real problem, because of that absence of a gold standard symptomatic system to the identification from claiming asymptomatic infections [5,10,11].

Despite the existence of different studies concerning visceral leishmanial infection among blood donors in the world, there are no data about the true burden of it in these subjects to estimate the real risk of TTL and distinguished potential for prevention and monitoring plans. According to the unfavorable impacts of TTL on the public health, more attentions would be desired for the epidemiological aspects of *Leishmania* infection worldwide. Thus, the aim of the present review was to estimate the prevalence ratio of leishmanial infection among blood donors in the world.

2. Methods

2.1. Searching approach

Between 1997 and 2016, prevalence of leishmanial infection among blood donors, systematically reviewed according to the PRISMA guideline [12]. Our study was limited to English, Persian and Turkish full text or abstracts. Records identified through 5 English and 5 Persian databases including Pub Med, Google Scholar, Science Direct, Scopus, Web of Science, Magiran, Elm net, Iran doc, Barakatkns (formerly IranMedex), and Scientific Information Database (SID).

Our study was achieved using medical subject headings (MESHs) terms and merging of several keywords including "*Leishmania spp*," "*Leishmania infantum*," "*Leishmania donovani*," "leishmaniasis," "visceral leishmaniasis," "kala-azar," "asymptomatic carrier," "blood donor;" "blood transfusion," "blood bank," and " blood donate".

Table 1
Baseline features of included studies based on various geographical regions.

Country/Continent	Author/Year	Year of Study	Sample size	Male subjects (%)	Age (years)	Molecular test	Serology test	Seropositive (%)	PCRpositive (%)	Leishmania spp
America										
Brazil	Luz et al. [34]	1994–1996	1194	NR	NR	NR	ELISA	108		LD
Brazil	França et al. [20]	2011	430	70.2	18–68	NR	IFAT	67		LI
Brazil	Fukutani et al. [35]	NR	700	74.4	mean 34	Real Time PCR, kDNA-PCR, ITS PCR	ELISA	38	26	LI
Brazil	Braga et al. [44]	2011	176	65.3	16–50	NR	ELISA	20		LB
Brazil	Monteiro et al. [43]	2011	431	NR	NR	kDNA- PCR	ELISA	57	20	LI
Europe										
France	Fichoux et al. [36]	1996–1997	565	NR	NR	kDNA – PCR	Western blot	79	9	LI
Greece	Kyriakou et al. [37]	NR	2000	41.6	18–60	kDNA – PCR, seminested PCR	Western blot	304	0	LD
Spain	Riera et al. [40]	NR	656	NR	NR	Nested-PCR	ELISA, Western blot	66	27	LI
Spain	Riera et al. [16]	NR	1437	NR	NR	Nested PCR	Western blot	44	18	LI
Italy	Scarlata et al. [42]	2005	1449	73.0	19–55	kDNA-PCR	IFAT	11	4	LI
Italy	Colomba et al. [41]	2002	500	NR	NR	NR	ELISA, IFAT	0		
Turkey	Ates et al. [39]	2008–2011	343	88.6	18–65	PCR	ELISA, IFAT, rk39	17	3	LI
Spain	Pérez-Cutillas et al. [22]	2008–2010	657	42.6	18–65	Real-time PCR, ITS PCR	ELISA	13	49	LI
Asia										
Bangladesh	Huda et al. [21]	2010–2011	1195	either sex	18–60	Nested PCR	rk39	3	0	LD
Iran	Sarkari et al. [23]	NR	2003	94.6	17–66	PCR	DAT	28	1	LI
Nepal	Timilsina et al. [38]	2010	507	78.5	18–>45	NR	DAT	5		LD
Total	–	–	13743	69.9	–	–	–	860	157	–

NR = not reported, LI = *Leishmania infantum*, LD = *Leishmania donovani*, LB = *Leishmania braziliensis*.

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