

Preplanned Studies

Visceral Leishmaniasis — China, 2015–2019

Zhengbin Zhou¹; Shan Lyu¹; Yi Zhang^{1,†}; Yuanyuan Li¹; Shizhu Li¹; Xiao-nong Zhou¹**Summary****What is already known about this topic?**

Visceral leishmaniasis (VL) is an important vector-borne disease in rural areas of western China. The spreading of VL made its prevention and control become more complicated.

What is added by this report?

The number of VL cases decreased from 2015 (n=498) to 2019 (n=166). However, the mountain-type zoonotic visceral leishmaniasis (MT-ZVL) cases increased from 2015 (n=82, 16.5%) to 2019 (n=122, 73.5%). In addition, both number and proportion of imported cases increased from 2015 (n=18, 3.6%) to 2019 (n=41, 24.7%). The re-emergence of MT-ZVL was considerable; 13 historically-endemic counties reported 48 indigenous cases. Infants and young children were the high risk population of VL (848, 62.4%) followed by farmers (303, 22.3%).

What are the implications for public health practice?

Both MT-ZVL and imported cases showed an increasing trend in China. Therefore, two actions are needed to control VL: 1) to prevent re-emergence and spreading of MT-ZVL; and 2) to ensure timely diagnosis and appropriate treatment to avoid fatal VL cases, especially in non-endemic areas.

Visceral leishmaniasis (VL), also known as kala-azar, is caused by *Leishmania* spp. and transmitted by sandflies of the genus *Phlebotomus* (1). Most cases die from complications within 1–2 years without timely diagnosis and treatment. Globally, VL is the second deadliest parasitic disease. About 50,000 to 90,000 new cases were reported annually globally (2), mainly those living in poverty.

There are three types of VL in China, namely anthroponotic visceral leishmaniasis (AVL), mountain-type zoonotic visceral leishmaniasis (MT-ZVL), and desert-type zoonotic visceral leishmaniasis (DT-ZVL). Their epidemiological characteristics are significantly divergent (3). VL was rampant in more than 600 counties north of the Yangtze River in the early 1950s,

and an estimated 530,000 VL cases were distributed in China in 1951 (4). The disease was controlled in most endemic areas through active control by 1960 and elimination standards were achieved in the early 1980s (4). However, VL rebounded from the late 1980s and an outbreak was observed in Jiashi County of Xinjiang Uyghur Autonomous Region in 2015 (5), with a record high of 353 cases reported that accounted for 70.9% of the total cases in China at that time. Although a great deal of human and material resources have been devoted to controlling VL, no comprehensive epidemiological analysis of VL based on the three endemic types has been reported since 2015. The objective of this study was to characterize the epidemiological status and trends of VL from 2015 to 2019 to provide evidence-based data to support the adjustment of appropriate strategies and measures in the future.

Data were collected via the National Notifiable Disease Reporting System (NNDRS) between 2015 and 2019. The indigenous and imported cases were defined according to epidemiological investigations on individual cases conducted by county-level CDCs. The spatiotemporal and demographic distribution of cases was analyzed through descriptive statistics with Microsoft Excel (version 2016, Microsoft, USA).

During 2015–2019, a total of 1,360 VL cases were reported from 216 counties in 17 provincial-level administrative divisions (PLADs). The number of VL cases decreased from 2015 (n=498) to 2019 (n=166). Among them, 1,188 (87.4%) cases were indigenous cases in 77 endemic counties and the other 172 (12.6%) cases were imported to 139 non-endemic counties. The number and proportion of indigenous cases decreased from 2015 (n=480, 96.4%) to 2019 (n=125, 75.3%), while the number and proportion of imported cases increased from 2015 (n=18, 3.6%) to 2019 (n=41, 24.7%). The indigenous cases consisted of 70 (5.9%) AVL, 589 (49.6%) DT-ZVL, and 529 (44.5%) MT-ZVL cases (Table 1). The proportion of DT-ZVL cases decreased from 2015 (n=385, 77.3%) to 2019 (n=3, 1.8%), while the number and proportion of MT-ZVL cases increased from 2015

TABLE 1. Number and proportion of visceral leishmaniasis cases in China (2015–2019).

Year	Endemic areas				Imported cases in non-endemic areas (n, %)	Total(n)
	AVL(n, %)	DT-ZVL(n, %)	MT-ZVL(n, %)	Subtotal(n, %)		
2015	13(2.6)	385(77.3)	82(16.5)	480(96.4)	18(8.6)	498
2016	22(6.8)	178(55.3)	95(29.5)	295(91.6)	27(3.4)	322
2017	24(12.4)	17(8.8)	113(58.2)	154(79.4)	40(20.6)	194
2018	11(6.1)	6(3.3)	117(65.0)	134(74.4)	46(25.6)	180
2019	0(0.0)	3(1.8)	122(73.5)	125(75.3)	41(24.7)	166
Total	70(5.1)	589(43.3)	529(38.9)	1188(87.4)	172(12.6)	1360

Abbreviations: AVL=anthroponotic visceral leishmaniasis; MT-ZVL=mountain-type zoonotic visceral leishmaniasis; DT-ZVL=desert-type zoonotic visceral leishmaniasis.

(n=82, 16.5%) to 2019 (n=122, 73.5%).

VL cases were mainly distributed in Xinjiang (n=673, 49.5%), Gansu (n=314, 23.1%), and Shanxi (n=126, 9.3%). A total of 1,188 (87.4%) indigenous cases were reported in 77 endemic counties in Xinjiang (30 counties), Gansu (16 counties), Shanxi (13 counties), Shaanxi (9 counties), Sichuan (6 counties), Henan (2 counties), and Hebei (1 county) (Table 2). Among them, Jiashi County (498 cases) in Xinjiang and Zhouqu County (110 cases), Wudu District (80 cases), and Dangchang County (55 cases) in Gansu Province were major VL endemic counties that reported more than 10 cases annually, which accounted for 54.6% (743/1,360) of total cases in the period. Jiashi County recorded the highest annual incidence (2.4/10,000), followed by Zhouqu County (1.6/10,000), and all other counties recorded less than 1.0/10,000.

In this period, VL reemerged in 13 historically-endemic counties: Wushan and Zhenyuan in Gansu Province; Xiangning, Quwo, Xiangfen, and Hejin in

Shanxi Province; Suide, Yanchang, Huazhou, and Linwei in Shaanxi Province; Linzhou and Long'an in Henan Province; and Xingtai in Hebei Province. There were 48 indigenous cases in total.

Approximately 56.4% (n=767) cases belonged to the age group of 0–2 years. In endemic areas, the age characteristics varied in different types of VL cases. For AVL and DT-ZVL, 42.9% and 95.1% cases were in the age group of 0–2 years with a median age of 3.7 and 0.9 years, respectively. For MT-ZVL, 51.6% cases in the age group ≥ 15 years with a median age of 19.5 years. In addition, the majority of imported cases (86.0%) were in group ≥ 15 years with a median age of 41.8 years (Table 3).

Infants and young children were the high risk population of VL, accounting for 62.4% (848/1,360) of the total cases, which was followed by farmers 22.3% (303/1,360). The majority cases (70.0%) in endemic areas were infants and young children, followed by farmers (17.4%). However, the occupational distribution varied in different types of

TABLE 2. Distribution and endemic types of visceral leishmaniasis cases in county-level administrative divisions (CLADs) in China (2015–2019).

Types	PLADs (No. of cases)	CLADs (No. of cases)
AVL	Xinjiang(70)	Kashgar (17), Shache (17), Kuqa (9), Yingjisha (7), Atush (5), Shule (5), Akto (3), Shufu (3), Shaya (2), Aksu (1), Wushi (1),
DT-ZVL	Xinjiang(589)	Jiashi (498), Bachu (39), Yuepuhu (11), Minfeng (8), Zepu (6), Yuli (4), Jiashi farm (4), Korla (3), Qiemo (3), Tumshuk (3), Gaochang (2), Awati (1), Celle (1), Luntai (1), Toksun (1), 44th regiment farm (1), 46th regiment farm (1), 50th regiment farm (1), 53rd regiment farm (1)
	Gansu(291)	Zhouqu (110), Wudu (80), Dangchang (55), Wenxian (15), Diebu (12), Huanxian (3), Qingshui (3), Xihe (3), Lixian (2), Maiji (2), Gangu (1), Qinzhou (1), Qingcheng (1), Wushan (1), Zhenyuan (1), Tongwei (1)
MT-ZVL	Shanxi(115)	Suburb of Yangquan (31), Pingding (21), Urban of Yangquan (15), Wuxiang (12), Mining of Yangquan (7), Xiangning (6), Xiangfen (6), Luzhou (5), Quwo (4), Daning (3), Hejin (2), Xiangyuan (2), Yuxian (1)
	Shaanxi(66)	Hancheng (35), Linwei (8), Huazhou (6), Qingjian (4), Yichuan (4), Baota (4), Suide (2), Yanchang (2), Ningqiang (1)
	Sichuan(47)	Jiuzhaigou (19), Heishui (13), Lixian (6), Maoxian (4), Wenchuan (4), Pingwu (1)
	Henan(8)	Linzhou (7), Long'an (1)
	Hebei(2)	Xingtai (2)

Abbreviations: CLADs=county-level administrative divisions; PLADs=provincial-level administrative divisions; AVL=anthroponotic visceral leishmaniasis; MT-ZVL=mountain-type zoonotic visceral leishmaniasis; DT-ZVL=desert-type zoonotic visceral leishmaniasis.

TABLE 3. Demographics of visceral leishmaniasis cases in China (2015–2019).

Characters	Endemic area				Imported cases in non-endemic area (n, %)	Total (n, %)
	AVL (n, %)	DT-ZVL (n, %)	MT-ZVL (n, %)	Subtotal (n, %)		
Age group/year						
0–2	30 (42.9)	560 (95.1)	164 (31.0)	754 (63.5)	13 (7.6)	767 (56.4)
3–6	10 (14.3)	14 (2.4)	47 (8.9)	71 (6.0)	4 (2.3)	75 (5.5)
7–14	9 (12.9)	3 (0.5)	45 (8.5)	57 (4.8)	7 (4.1)	64 (4.7)
≥15	21 (30.0)	12 (2.0)	273 (51.6)	306 (25.8)	148 (86.0)	454 (33.4)
Occupation						
Infants and young children	42 (60.0)	574 (97.5)	215 (40.6)	831 (70.0)	17 (9.9)	848 (62.4)
Students	7 (10.0)	3 (0.5)	53 (10.0)	63 (5.3)	7 (4.1)	70 (5.1)
Farmers	11 (15.7)	9 (1.5)	187 (35.4)	207 (17.4)	96 (55.8)	303 (22.3)
Workers	1 (1.4)	0 (0.0)	9 (1.7)	10 (0.8)	14 (8.1)	24 (1.7)
Officials	1 (1.4)	0 (0.0)	11 (2.1)	12 (1.0)	3 (1.7)	15 (1.1)
Housewives	7 (10.0)	1 (0.2)	27 (5.1)	35 (3.0)	14 (8.1)	49 (3.6)
Others	1 (1.4)	2 (0.3)	27 (5.1)	30 (2.5)	21 (12.2)	51 (3.8)
Gender						
Male	38 (54.3)	338 (57.4)	327 (61.8)	703 (59.2)	119 (69.2)	822 (60.4)
Female	32 (45.7)	251 (42.6)	202 (38.2)	485 (40.8)	53 (30.8)	538 (39.6)
Total (n)	70	589	529	1,188	172	1,360

VL cases. For AVL, the predominant cases (60.0%) were infants and young children followed by farmers (15.7%). For DT-ZVL, most of cases were infants and young children (97.5%). For MT-ZVL, the majority of cases were infants and young children (40.6%) followed by farmers (35.4%). In non-endemic areas, the majority (55.8%) cases were farmers (Table 3). In addition, the gender distribution showed that most cases (n=822, 60.4%) were male, and 538 cases (39.6%) were female.

DISCUSSION

Reemergence of VL presented a significant challenge for counties that had previously achieved elimination. Between 2015 and 2019, MT-ZVL reemerged in 13 historically-endemic counties with 48 indigenous cases reported in Gansu, Shanxi, Shaanxi, Henan, and Hebei provinces. Surveillance and response to reemerging VL must be strengthened because VL may be transmitted in previously endemic areas where sandflies still exist.

The downward trend of VL cases from 2015 to 2019 may have been due to large-scale renovations of old housing supported by poverty alleviation campaigns in rural areas, particularly in southern Xinjiang which was the most affected area in China. The greatly improved housing conditions of residents

led to reductions in breeding sites and density of sandflies and subsequently decrease the incidence of DT-ZVL and AVL. However, MT-ZVL showed an increasing trend, which was likely explained by the resurgence of leishmaniasis in the historically endemic counties in central and western China. Several factors contributed to the reemergence of MT-ZVL. First, the number of roaming dogs increased the spread of VL from the natural nidus, where circulation of VL was maintained in the wild animals, to residential areas (4). Second, imported dogs with visceral leishmaniasis facilitated the reestablishment of VL while sandflies widely infested mountainous areas (4). The imported VL cases increasing rapidly in non-endemic areas may be due to growing number of migrant workers and tourists to endemic areas.

The epidemiological characteristics of the three VL types in this study were mostly consistent with results reported in the past, whereas the distribution of age diverged from previously reported results. Previous studies showed that juveniles were mostly affected by AVL and that few infant cases were involved (6). However, the results here indicated that the majority (42.9%) of cases were aged 0–2 years. Therefore, our result highlighted the importance of infant infection in endemic areas and hence infants should be more prioritized in the massive screening, particularly in

southern Xinjiang. In contrast, the proportion of MT-ZVL cases found in infants and young children under 5 years declined from 86.5% in the 1950s (3) to 39.9% in this study. This may be related to population structure changes due to urbanization and family planning policies in China (6). Although the number of AVL and DT-ZVL cases declined, VL will likely rebound without sandflies being fully controlled (7). Therefore, we recommend that national surveillance on sandflies should be established sooner.

This study indicated that the number of DT-ZVL cases decreased, while MT-ZVL and imported cases increased. Therefore, control efforts should be strengthened to prevent further growth of MT-ZVL cases. Prevention of infection can be achieved by utilizing insecticide-impregnated collars or applied products, such as deltamethrin on dogs, the effectiveness of which directly depends on coverage and loss rate. Stray dogs may function as infection reservoirs if not targeted, so stray dog population management should be part of VL control programs (8). Moreover, although no deaths from VL were reported from NNDRS, high levels of misdiagnosis and mortality rates of VL were reported by hospitals (9–10). Hence, accurate diagnosis and prompt treatment by medical staff should be improved to avoid fatal cases especially in non-endemic areas where leishmaniasis has been neglected.

We conducted a nationwide type-specific analysis for VL in the past five years and highlighted the important findings, which will be helpful for policymakers and stakeholders. The present study was subject to at least one limitation. Since VL has often been neglected, the results of the study were likely affected by case underreporting, and the number of cases that were misdiagnosed, mistreated, or fatal were likely higher than the numbers extracted from the NNDRS (9–10).

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