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International Journal of Zoology and Animal Biology
ISSN: 2639-216X

Leptospirosis, an Underestimated Lethal Zoonosis Who's Spread May Be Favored during the Covid-19 Pandemic

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Mini Review
Volume 4 Issue 6
Received Date: December 15, 2021
Published Date: December 28, 2021
DOI: 10.23880/izab-16000342

Abstract

Leptospirosis is the most widespread bacterial zoonosis in the contemporary world. Despite its negative impact on human and animal health, is underestimate since the last century. Several factors, objective and subjective, prevent an approach to the real behavior of leptospirosis. This proposal aims to alert to factors that can favor an expansion of leptospirosis during COVID-19. The main factors involved are at least six: a) its erroneous underestimation as zoonosis, first of all. b) The barriers between developed and underdeveloped countries, more influential than climatic aspects. c) The reduced presence of the human-animal-environment trinomial in the investigations carried out. d) The absence of the biofilm variable in the former studies. e) The underestimation of sheep, goats and horses as reservoirs of the spirochete. f) The gap between the knowledge generated with the molecular taxonomy of *Leptospira spp*. and diagnostic techniques used globally. The almost absolute subordination of surveillance systems and health services and institutions as a function of COVID-19 increases the lack of control of the old zoonosis and its consequent increase. The magnitude of the inadvertent impact has not assessed yet.

Keywords: COVID-19; Reemerging Diseases; *Leptospira*; Leptospirosis; Zoonosis

Introduction

When we hear about emerging and re-emerging diseases, we immediately assume that it is current. However, it is a continuous phenomenon originated at the end of the Second World War. Animals (sick or acting as reservoirs) transmitted about 60% of these diseases to people [1]. Leptospirosis is the most widespread bacterial zoonosis on the planet at this time [2]. Expansion favored by the wide spectrum of reservoirs involved. All mammals (including pinnipeds and bats), birds, amphibians, reptiles, and even fish, can act as carriers of pathogenic serovars of *Leptospira* spp. [2,3]. Domestic animals play an important role in this diffusion [4]. Other factors that are generally not valued favor its current extension [2].

Annually 1.03 million cases of leptospirosis occur in humans, 60.000 of which lose their lives [5]. Although it may seem like a high figure to us, it is lower than what happens in reality [2]. Another contradiction in an ancient zoonosis that persists in the 21st century, in an expansive, lethal way, and despite this, is undervalued. Although surprising, it is not the only case [6]. Various factors, both objective and subjective, have contributed to its underestimation since the last century. All these causes, in the midst of a pandemic such as COVID-19, may favor the expansion of this zoonosis [2]. Forward we analyzed some of the main factors.

Objective: to alert about objective and subjective factors that can favor an expansion of leptospirosis during COVID-19.

Undervaluation and Geographic Determinism

The undervaluation of any disease constitutes its Achilles heel and favors its persistence, and even its increase. It is determined by objective and subjective criteria that overlap to condition the false image of the problem [2,5]. Very often, what affects and injures one region of the planet remains unnoticed until it poses a risk to the rest of the world [2,6,7]. Undervaluation and geographic fatalism are two components that have governed the fate of leptospirosis from the end of the last century to the present [2]. It was not always like this.

Until the end of the 1980s, the diagnosis of this zoonosis had priority in the global veterinary and public health surveillance systems. The results up to that point led to the wrong conclusion: the zoonosis was fully controlled. It was based on: 1) the reduced number of cases reported in both humans and animals. 2) The existence of options for its prevention and therapy. 3) Confidence in having adequate epidemiological control of zoonosis [8]. Perhaps an illusorily reality in those countries with a developed economy in the northern hemisphere. Nothing to do with what happened in the poorest areas of the planet [2].

As the predicted control was nothing more than a misconception, since the last century the zoonosis persistence of has been attributed to those geographical locations characterized by hot and humid environments. Such is the case of the Caribbean, Latin America, Oceania, Asia and Africa, where it has a tendency to endemism [9]. In these regions, leptospirosis is synonymous with poverty and unhealthy conditions a product of poor health services [10]. In some Latin American countries it is part of an uncertainty in which it is intermingled with Dengue and disappears numerically from the official reports despite the fact that 50% of the reported cases actually suffer from leptospirosis [11]. An inescapable reality where socioeconomic factors influence more than climatological factors and falsify the inaccuracy of the official fatality reports [2].

The dramatic situation in these less favored areas does not mean that the rest of the world is refractory to the disease. Nor that the constant cases and outbreaks occur are the consequence of those who, as tourists, venture to the risks imposed by these hot and tropical summer resorts [2]. For example, in the United States assumed the disease because of imported cases from Puerto Rico and Hawaii [12]. A plausible interpretation in which, however, the increasing cases and outbreaks generated from cisterns, swimming pools and other water reservoirs are ignored [13], as well as the marked extent of zoonosis in dogs [14,15]. Both factors will be ample later.

Supporting bought previously analyzed factors, it is worth adding that Chatterjee, et al. [16] place leptospirosis at the top of their list of bacterial zoonosis for two reasons: 1) a global spread where Antarctica is the only region free of the etiological agent. 2) The inconceivable undervaluation of the disease. Criterion, the latter, supported by the World Health Organization (WHO), which characterizes it as "neglected tropical disease in the human sphere" [17]. Inattention that has been even greater in the veterinary field although no organization of such hierarchy recognizes it [2,10,18].

The Human-Animal-Environment Trinomial

Another factor affecting a more realistic approach to the behavior of *Leptospira* spp., and closely related to the above, lies in the scant attention paid to its biofilm phenotype in research aimed at studying its behavior in diverse ecological environments [19]. Its biofilm stage, in addition to being hegemonic (99.9%) in all natural environments, is what justifies its prolonged persistence in water reservoirs and in soils [20]. Contact with these contaminated natural environments constitutes one of the most important sources of contagion to humans today [2]. Once this limitation is assumed, the role of this phenotype in the pathogenesis and epidemiology of *Leptospira* should be addressed, a topic to prioritize in present and future research, especially when it has already revealed interesting behaviors of other bacterial pathogens [6].

Although rats and mice are emphasizes in this zoonosis, other groups of animals, both wild and domestic, play a decisive role as reservoirs. In this regard, carnivores, pigs and large ruminants stand out [15,21-24]. However, there are three domestic species that are generally underestimated or even missed in epidemiological surveys: sheep, goats, and horses [2,25-27]. Raising the first two is the livelihood of large sectors of the population in developing countries. The close contact imposed by this form of production encourages direct contagion to the people involved [2]. Equines behave as spirochete reservoirs similar to bovines, pigs and canines [26,27]. Hence, the high epidemiological risk they impose, especially in those cities where are used to transport the population [27]. However, there is a marked tendency to ignore participation in the phenomenon analyzed [2].

Factors analyzed demonstrate a divorce between three elements that are indissolubly united: humans-animals-environment. Only through research developed from the conception of One Health, a faithful approach to the behavior of this zoonosis is possible [2].

Lags between Advanced *Leptospira* Taxonomy and Contemporary Diagnosis

Despite the fact that undervaluation is the factor that,

indisputably, slows the understanding of leptospirosis in its real dimension, the genus *Leptospira* has always attracted the attention of those who deal with taxonomy since the last century. In the current one, the use of molecular techniques contributed to unveiling new species at an increasing rate: 21 [28], 35 [3], and 64 [5]. A quantitative and qualitative leap that marks a milestone in the taxonomic immediacy of this genus. However, perhaps due to the inherent underestimation of zoonosis, the fruit of so much progress is limited to elite of knowledge on the subject. There is no complement between the theoretical achievements and the consequent diagnostic techniques on a global scale. Those who lead the day-to-day surveillance and control of leptospirosis in human and animal health laboratories in much of the world do so using the micro-agglutination technique (MAT). In most cases, they use batteries in which many of the regulatory serovars are absent or their selection is outdated [2,29,30].

The taxonomic achievements described are not "the problem". Rather, they lay the foundations for solutions in the medium or long term, depending on the priorities or underestimations inherent to the zoonosis. As long as ignoring their value and implications for human and animal health - the real problem - they will persist as reemerging diseases, as does the divorce between knowledge and objective solutions. Something that the current pandemic substantially aggravates [2].

Leptospirosis Amid COVID-19

It is ignored in numerical terms the imperceptible worsening of leptospirosis in the human and animal sphere during the last two years of COVID-19. However, in the former, their synergies with the virus are already alarming, particularly in those contexts marked by poverty and inequalities [31,32]. Without the justified drama that characterizes COVID-19, leptospirosis in complicated patients causes similar clinical symptoms, including cytokine storm [33]. Once again, a percentage of the numerical impact of the underrated zoonosis is lost to a greater evil. The use of predictive models in order to estimate the status of tuberculosis under COVID-19 gives an alarming idea. They predict an increase in its fatality in humans by 20% over the average of the last five years prior to the pandemic [34].

Undervaluation is the status of multiple zoonosis during the last 60 - 70 years; a reality improved with COVID-19 [2]. The moment calls for focusing efforts to rid humanity of this challenge, perhaps the greatest it has ever faced. This does not prevent at least preparing the minds and assuming that, in its shadow, old zoonosis, such as leptospirosis, even with compatible symptoms in their initial stages, gain ground and can be lethal. A first step to achieving true control involves assessing them in their true dimension.

Conclusion

The reemergence and expansion of leptospirosis in the 21st century is the consequence of a sum of objective and subjective factors. The almost absolute subordination of surveillance systems and health services and institutions as a function of COVID-19 increases the lack of control of the old zoonosis and its consequent increase. A first step to achieving true control involves assessing leptospirosis in its true dimension.

Conflict of Interest

The authors have declared that there is no conflict of interests.

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