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A REVIEW ON: LEPTOSPIROSIS DISEASE

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ABSTRACT

Leptospirosis is a reemerging infection in tropical nations like India and one of the most neglected zoonotic diseases of public health concern globally. (Bharti *et al.*, 2003; Levett, 2001). In order to regulate the infection and determine the reported disease rate, epidemiological and other vital data are limited for the least studied disease. This essay attempts to examine the importance of leptospirosis as sapronosis, which is as underappreciated as the sickness itself. The goal of the research evaluation was to reduce the disease's detrimental effects by gaining an epidemiological understanding of the infection. To comprehend the literature on important and understudied topics such epidemiology, transmission, diagnosis, therapy, and infection control, a combined review and analysis were conducted. Using the published data from PubMed, a systematic analysis was conducted to extract information on the reported circulating strains and research gaps in India (Gupta, Wilson and Ravindra, 2023).. In order to limit the spread of infection using the one health approach (OHA) (Krishnan, Balasubramanian and Kumar, 2024)., the paper comprehensively examines important inference areas of infection transmission, resolves lacunae in critically underappreciated regions of infection, and suggests solutions to control leptospiral infection. The article also discussed why and how India's "One health approach" is the most effective way to research and manage leptospirosis.

KEYWORDS: Leptospirosis, Risk Factor, Prevalence, Diagnosis, Zoonotic Disease.

Graphical Abstract

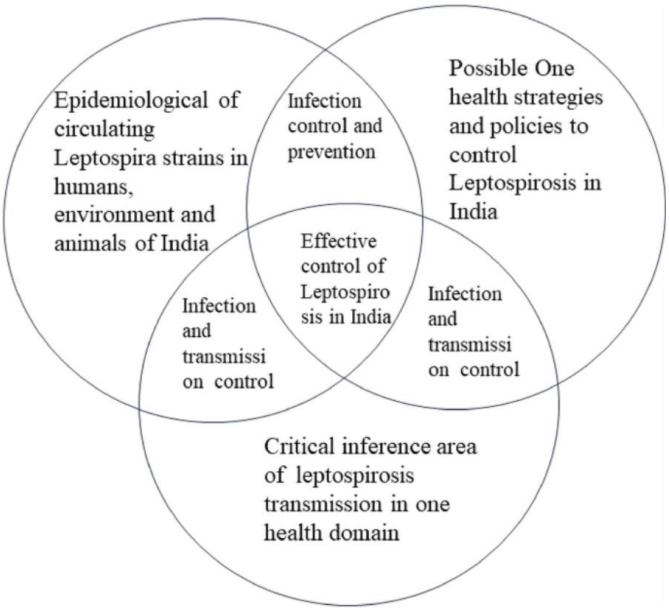

Fig 1: Graphical Abstract.

INTRODUCTION

Leptospirosis is a bacterial zoonotic infection that has a high rate of morbidity and death. (Levett, 2001)With the majority of cases coming from South America, the Caribbean, and South Asia, it is one of the most common but underappreciated zoonoses. (Bharti *et al.*, 2003).According to one estimate, 58,900 deaths are reported annually Between the tropics of Cancer and Capricorn, (Adler and de la Peña Moctezuma, 2010). over three-fourths of cases take place .According to a systematic review conducted between 1970 and 2012, South Asia accounted for 13% of all outbreaks . An evidence gap map on leptospirosis in India suggested a paucity of evidence on management and control. The epidemiological characteristics, clinical profile, laboratory parameters, diagnosis, treatment, and prognosis of leptospirosis patients in India were the focus of this systematic review.

Humans, dogs, rats, and many other wild and domesticated animals can contract leptospirosis, a blood infection caused by bacteria of the genus Leptospira There may be no symptoms at all, minor ones like fevers, headaches, and muscular aches, or severe ones like meningitis or lung haemorrhage. The acute, severe form of leptospirosis known as Weil's disease (/Òvaňlz/ VILES) results in bleeding, kidney failure, and jaundice (yellowing of the skin and eyes). Severe pulmonary haemorrhage syndrome is the term for lung bleeding linked to leptospirosis.

Human sickness is caused by more than ten genetic strains of Leptospira. The disease can be spread by domestic and wild animals, most frequently rodents.The bacteria can infect people by animal faeces or urine, polluted water or soil, contact with the mouth, nose, or eyes, or skin breaches.The disease is especially prevalent among low-income individuals who reside in unsanitary locations, farmers, and pest control personnel in underdeveloped nations.In developed nations, it happens during periods of intense rainfall and poses a risk to sewage workers, pest controllers, and anyone engaging in outdoor activities in warm, humid environments.The diagnosis is usually made by looking for bacterial DNA in the blood or testing for antibodies against the germs.

METHODOLOGY

To find leptospirosis papers published up until August 2, 2022, a systematic review of the literature was conducted in two databases (PubMed and Scopus). (Review Manager, 2014). contained were studies that contained clinical, laboratory, and treatment information of leptospirosis cases diagnosed in India, including randomized controlled trials, cohort studies, case-control studies, cross-sectional studies, and case series. Excluded were case reports, in vitro research, and studies involving non-human participants. Furthermore, studies lacking enough clinical data were also disqualified. The search term that was utilized was: (Moher *et al.*, 2009; Page *et al.*, 2021).

Weil's disease, leptospirosis, leptospira, or signs and symptoms, as well as laboratory, clinical, epidemiological, hemorrhagic, neurological, penicillin, doxycycline, or azithromycin treatments, and (India).

Two writers (PR and WW) conducted the title-abstract and full-text screening. In order to get an agreement in cases where there was none, the third author (NG) was consulted. A predetermined worksheet was used to enter the data from the included studies, including epidemiology, clinical characteristics, laboratory values, treatment, and outcome. The data analysis was done by NG. For each of the variables that were included, the pooled proportion was determined. The Revman program (version 5.3, Cochrane Nordic, Copenhagen, Denmark) was used to compute a pooled mortality. The forest plot was created using a random effects model.

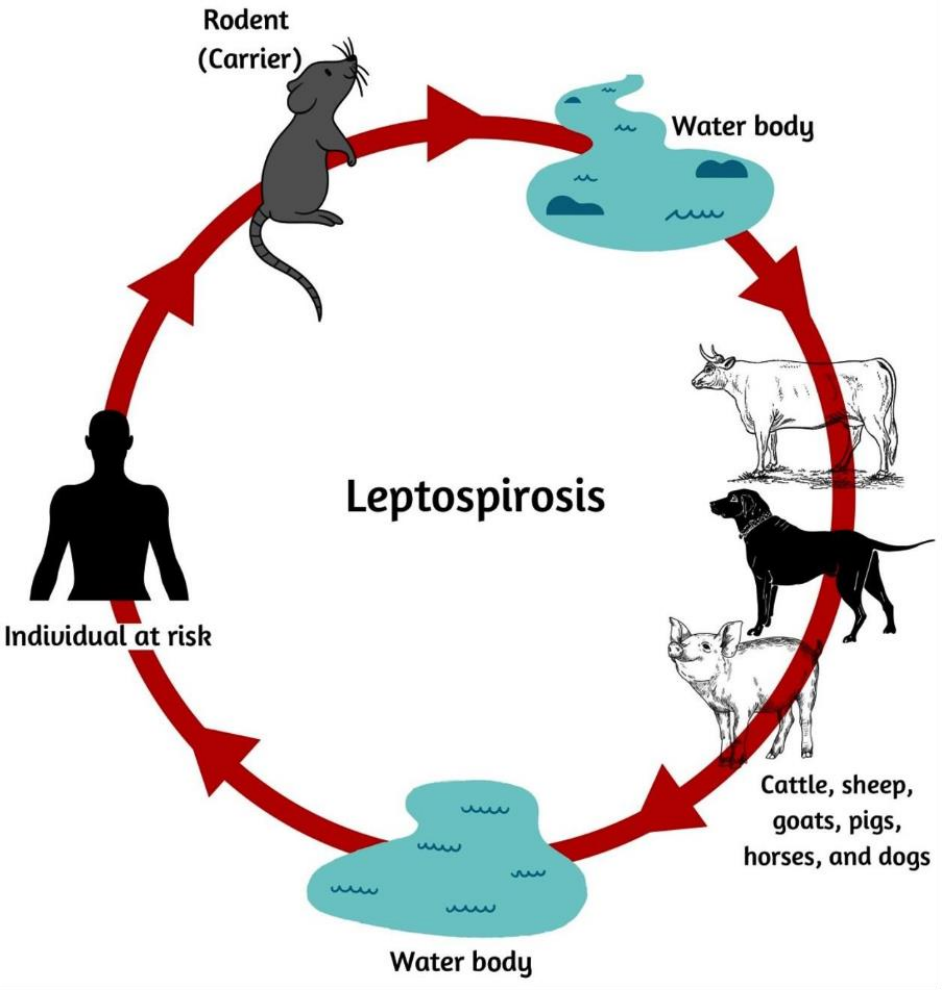

Fig 2: Methodology of Leptospirosis.

Causes

The spirochaete, which has 82 species in the genus Leptospira, family Leptospiraceae, and order Leptospirales, is the causal agent of leptospirosis. (Adler and de la Peña Moctezuma, 2010). The genus is separated into pathogenic and non-pathogenic strains according to their pathogenicity. distinct agglutination reactions in MAT are responsible for the distinguishing of distinct serovars. Additionally, Routray et al. identified more than 300 serovars for L. interrogans and 60 serovars for L. biflexa.23 (Faine *et al.*, 1999).

Leptospires can maintain an alkaline pH and are motile and aerobic, but they cannot endure in a hot, dry environment. Gram-negative bacteria are present. Along with Gram staining, other techniques include immunofluorescence and silver impregnation staining, which are then visualized using a dark field microscope. The Ellinghausen-McCullough-Johnson-Harris (EMJH) medium is the most widely used medium for Leptospira culture.

A few tests, such as assessing in vivo pathogenicity and detecting outer membrane proteins, are carried out since the morphology of the pathogenic and non-pathogenic strains cannot be distinguished. Other virulence factors and outer membrane proteins have already been thoroughly described. (Picardeau, 2017)

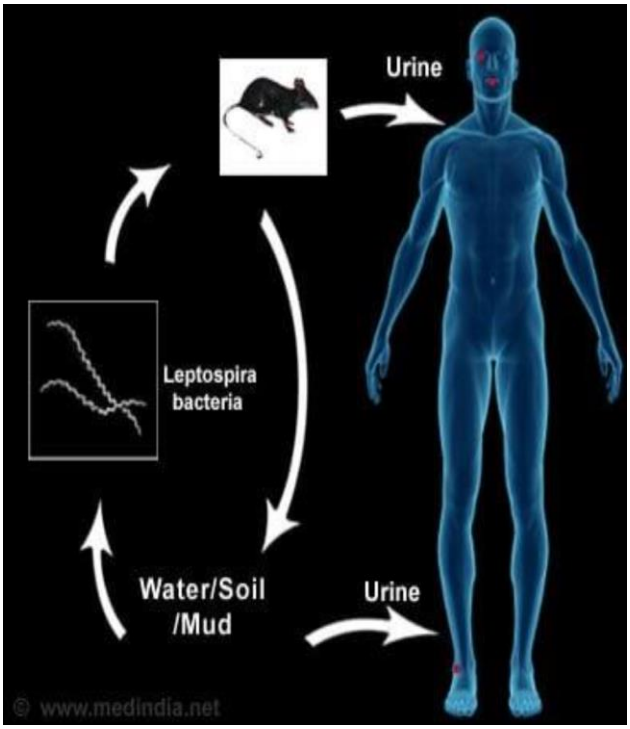

Fig. 3: Causes of Leptospirosis.

Clinical Sign

In both humans and domestic animals, mainly dogs, cattle, and pigs, (Ellis, 2015) leptospirosis manifests as fever, lung symptoms, renal and hepatic insufficiency, and reproductive failure. Typical signs of canine leptospirosis include fever, jaundice, vomiting, diarrhea, intravascular disseminated coagulation, uremia followed by renal failure, hemorrhages, and death (Levett, 2001; Bharti *et al.*, 2003). Symptoms of leptospirosis in pigs and cattle include agalactia, fetal mummification, abortion, and weak newborns. From a mild, influenza-like illness to a severe infection with respiratory distress and renal and hepatic failure (Weil's disease), humans can encounter a wide range of symptoms.

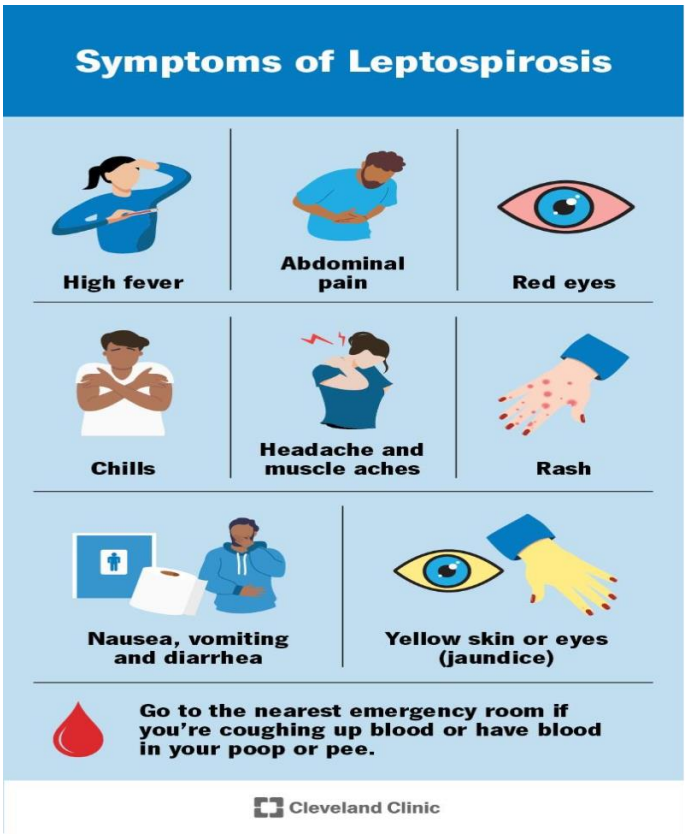

Fig 4: Clinical Sign and Symptoms.

TRANSMISSION AND RISK FACTORS

Because leptospires may survive longer in warm, humid environments, leptospirosis cases are more common in tropical locations than in temperate ones. Human infection is more likely to occur in nations where there is a possibility that the general public will come into contact with infected animals (Adler and de la Peña Moctezuma, 2010).. Because Leptospira spp. can infect and thrive in a variety of hosts, its host range is wide. Numerous domestic, marine, and wild animals exhibit it. While other animals including cattle, pigs, and dogs may also serve as carriers and transmitters of infection to humans or other animals, (Bharti *et al.*, 2003).rodents are the main reservoir host. Fencing to prevent stray dogs from entering farms and managing rat infestations on farms can be successful preventative measures. Contact with contaminated water or soil can result in diseases in both humans and animals.

7- Transmission

Direct contact with an infected animal or indirect contact with soil or water tainted with an infected animal's urine are the two ways that leptospirosis is spread. Reports of human-to-human transfer are uncommon. WHO, 2003). Humans and animals who come into contact with infected pee can become infected. Human occupational groups such as farmers, abattoir workers, veterinarians, rice field workers, and animal handlers, as well as recreational activities like swimming and hunting, are the primary risk factors for leptospirosis. (Bharti *et al.*, 2003 As a result, it is often referred to as mud fever, sewer worker illness, or paddy field worker disease. The purchase or introduction of diseased cattle, rats on the farm, the degree of cleanliness during milking, the presence of leptospiral vaccine, and shared grazing with shared water supplies are all significant risk factors for animals. existence of additional animals on the farms, such as pigs, horses, dogs, lambs, and goats Additionally, leptospirosis can spread through an infected animal's semen. (Ellis, 2015).

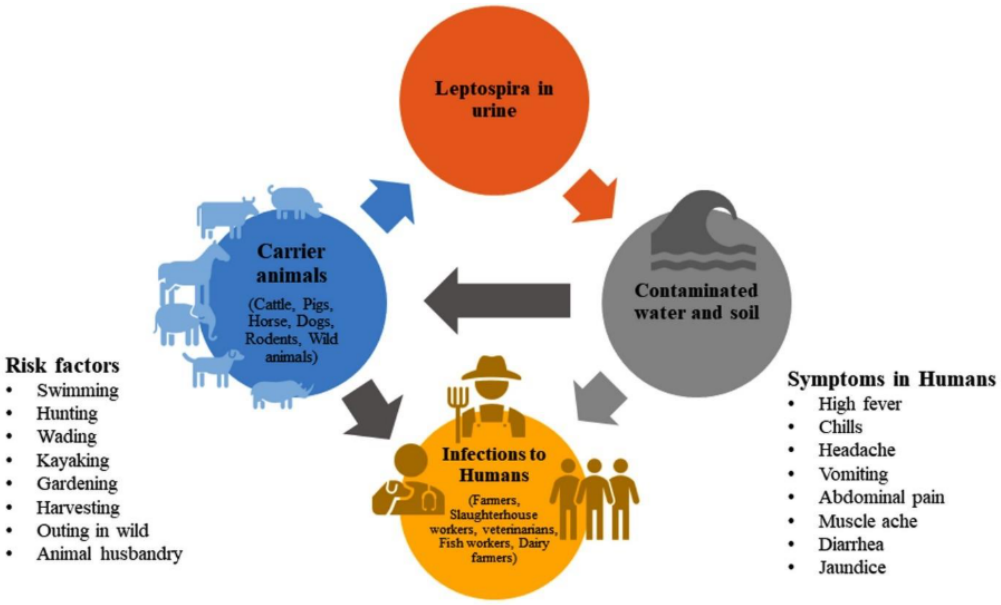

Fig 5: Transmission of Leptospirosis.

Leptospirosis Prevention and Control Program

This program's goal was to improve laboratory support and disease surveillance so that the burden of disease could be tracked both before and after intervention for control. The National Center for Disease Control has been chosen to serve as the program's nodal agency (NCDC, 2022).

The program was carried out in the endemic states of Gujarat, Kerala, Tamil Nadu, Maharashtra, Karnataka, and the UT of the Andaman and Nicobar Islands. Epidemiological examination of IDSP data showed that, in addition to the Program states specified under the 12th Five-Year Plan, instances are frequently reported from states including Uttar Pradesh, Assam, Goa, and the UTs of Dadra Nagar Haveli, Daman, and Diu. As a result, the program was extended to incorporate additionalOne UT and three states. The program is currently being implemented in 181 districts throughout 14 States and UTs (12 States and 2 UTs). (IDSP, 2022).

Institutional Mechanism for Program Implementation: At the Center: The Ministry of Health and Family Welfare will serve as the program's nodal ministry. It is suggested that policy decisions be made using the current NHM's MSG & EPC method. A National Technical Advisory Committee now in place, chaired by DGHS, (DGHS, 2022). to provide guidance on all technical elements of the programme.

As the Coordinating Agency for the Program's Implementation in the Endemic States, NCDC is responsible for the following: training core trainers, including medical, paramedical, and laboratory personnel; releasing funds to the program states; developing prototype IEC material; strengthening diagnostic components; establishing interlaboratory quality control; monitoring and evaluation; and holding regular meetings to review the program.

At the state and district levels: The State Health Society will carry out the initiative. The District Health Society will serve as the program's overall implementing organization at the district level.

Fig 6: Prevention and Control.

RESULT AND DISCUSSION

According to the literature review, leptospirosis was initially thought to be present in prisoners in the Andaman and Nicobar Islands in the early 1900s (Krishnan *et al.*, 2024). Nonetheless, there is still a lack of thorough knowledge regarding important topics including etiology, transmission mechanisms, and illness patterns. The Indian subcontinent's status as a leptospirosis hotspot is influenced by its spatial and temporal features. Human infections are known to be caused by the majority of L. interrogans serogroups seen in animals, but the opposite situation has not been documented. Apart from the rodent population, no other harmful species of Leptospira other than interrogans were detected in the analysis. Although there have been reports of human infection via animal sources, it is unknown how the virus spreads and how humans, animals, and the environment interact. Determining the sickness rate requires an understanding of how diseases spread and the function of many domains in zoonotic infections. The transmission pattern of the infection among animals, humans, and the environment in India cannot be identified since, according to our review, few studies have examined two domains of the disease cycle, and none have covered all three primary domains of infection Geographically, leptospirosis is endemic in the southern Indian states, especially Tamil Nadu, Karnataka, Kerala, and Puducherry, where many cases have been reported. (Gupta *et al.*, 2023). Leptospirosis infections and reports are particularly high in the Andaman and Nicobar Islands. On the other hand, although leptospirosis is less common in Maharashtra, Gujarat, Kolkata, and Orissa, these states are also endemic. According to epidemiological research publications, Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Orissa, and the Andaman and Nicobar Islands account for more than half of all studies. There has been a change in the serogroups that impact

humans and animals in recent years, even though the common serogroups that were previously included were still found to infect the hosts.

In general, zoonotic disease research focuses mostly on humans; however, this study discovered that animal leptospirosis is a more extensively researched topic in India than human leptospirosis. On the other hand, thorough research on the infection state in both human and animal populations is necessary for efficient infection control. Aside from domestic animals, the critical role that wild animals play in sustaining leptospiral infection has not yet been investigated, particularly at the ecological interface between humans and wildlife. In India, the least studied area of zoonotic pathogens is environmental studies on leptospirosis. Because leptospirosis is difficult to detect and monitor and necessitates specialized knowledge, healthcare professionals, risk groups, veterinarians, public health scientists, and epidemiologists frequently fail to recognize the illness because of their lack of awareness and carelessness. (Krishnan *et al.*, 2024).

CONCLUSION

Because leptospirosis is a unique and picky pathogen that necessitates advanced laboratory conditions for both diagnosis and study, it has historically been disregarded, and there is a dearth of information on the bacteria that can be used to control the infection. (Levett, 2001).Delays in reporting infections, lack of process and medium of transmission, and lack of transferability of knowledge about the nature of the infection could all be contributing factors to the rise in infection, emergence, and reemergence of the disease in India . The review explored the lacunae to control infection and epidemiology in India. Epidemiology is an essential source of information for precise illness diagnosis, treatment, and infection control. The thorough understanding and efforts to limit infection are complemented by the systematic analysis of data from the articles to extract cumulative data on circulating strains of pathogenic leptospires for the first time. The circulating genomospecies seen mostly in humans and animals is Leptospira interrogans. Nonetheless, Leptospira borgepetersenii has been found in rats, and further research and investigation are needed to fully understand how the infection spreads to the other two disease domains in India. (Krishnan *et al.*, 2024; WHO, 2003).

Insightful knowledge on the vital, dynamic, and important domains of leptospirosis infection, transmission, and epidemiology will be added by the comprehensive, One Health approach. (Krishnan *et al.*, 2024; WHO, 2003).

The method by which microorganisms in environmental stresses continue to cause infectious diseases, particularly zoonoses, was also covered in the study. However, the illness cannot be managed solely by standard and conventional methods because it is a sapronosis. The "environmental reservoirs" and important observational regions that support pathogen survival, maintenance, and proliferation as well as infection transmission include water bodies and soil/environmental domains. Therefore, in order to effectively manage the infection, disease control interventions in this area of one health domain transmission should be viewed as crucial and given more focus by highlighting one health idea that has been mentioned.

In nonendemic areas, OH lab assistance for infection diagnosis and surveillance, followed by prompt or simultaneous information provision, could successfully stop the spread of infection.[107] Additionally, it uses the supporting information provided by OH to reduce the cost of disease diagnosis, treatment, and prevention. The database facilitates the exchange of information concerning infections. It gives qualified experts the opportunity to present the most pertinent and corroborating information regarding a disease that will be determined to be an

appropriate treatment at medical facilities located close to hotspots. Furthermore, the public will have access to the database, which might potentially improve the outcomes.

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