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One Health Implication of Leptospirosis

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Abstract

Leptospirosis is a globally important zoonotic disease caused by the pathogenic Gram-negative bacteria of the genus Leptospira. The disease occurs in nearly all mammalian species and it is more common in the tropical regions because of the longer survival organism in the environment. In contaminated environment frequent exposure to animals and humans indicate one health approaches. It caused by numerous serovars of leptospira interrogans that belong to the genus Leptospira. Leptospira interrogans is not the only serovar that resembles the disease, which affects almost all mammalian species. The primary reservoir animals are known as rats and mice. Direct human transmission through exposed mucosal membranes and damaged skin to the urine of infected animals. The laboratory testing on various animal species do not significantly alter the clinical indications of leptospirosis. The best control for the disease are vaccination, quarantine, and rodent management. Tropical regions with warm, humid weather and alkaline or neutral soil are better suited for leptospira survival. Applying effective control measures and raising public awareness of leptospirosis zoonotic transmission is recommended. Concerned body should involve in supporting the study of the leptospirosis situation in deprived nations, such as Ethiopia.

Keywords: leptospirosis, leptospira, zoonosis, rodent, one health

1. Introduction

Leptospirosis is a reemerging bacterial disease and one of the most common zoonosis in the world. It causes severe illness in animals and humans and caused by pathogenic species of spirochetes of the genus Leptospira that thrive directly within hosts and reservoirs (such as rodents), and indirectly within the environment (Bharti et al., 2003; Brown and Prescott, 2008). In many tropical and subtropical areas, leptospirosis is an endemic disease. Leptospirosis causes more than 60,000 fatalities in humans each year, and it is estimated that about one million people are infected (Mwape et al., 2015).

Leptospirosis acute infectious sickness with enlargement of spleen, jaundice, and nephritis. The first distinct visual observation of Leptospira was made in 1907 by Stimson from sliced human post-mortem renal tissue, and its presence in rats was recorded in 1916. Leptospirosis were first isolated in pure culture by Japanese investigators in 1914 (Levett and Haake, 2010). Rats is the primary source of leptospirosis in urban areas because of inadequate sanitation infrastructure like open sewage systems (Felzemburgh et al., 2014). When damaged skin or mucous membranes of the eyes, mouth, nose, or vagina come into contact with infected kidneys, urine, or settings contaminated with urine, humans get infected. The main methods of infection transmission are direct contact with rat urine and indirect contact with rat urine-contaminated water, soil, or food (Leilber et al., 2016).

A wide range of clinical signs define leptospirosis in animals. Infertility, mastitis, milk drop syndrome, stillbirth, abortion, and stillbirth are its chief reproductive losses (Radostits et al., 2007). Leptospirosis in people can result in headaches, fever, chills, sweating, and myalgia. Lethargy, sore joints, and protracted illness are possible additional symptoms. Some extremely pathogenic serovars can result in fatal pulmonary hemorrhaging (Peter and Narasimha, 2011).

Leptospirosis, classified as a neglected a pathogenic spirochete bacteria of the genus Leptospira causes tropical illness (Ame and M, 2021). In addition, there are two different types of leptospira: L. biflexa, a non-pathogenic species, and L. interrogans, a pathogenic species that causes leptospirosis (Robi, 2020). Leptospirosis, which is categorized as a direct anthropozoonosis and is one of the most common bacterial diseases in the world, affects both people and a wide variety of animals. Leptospirosis is typically thought of as a disease that only affects rural areas, although it has been claimed that an urban outbreak of the disease's severe form happens every year and causes a large amount of mortality (Tewodros and Makash, 2012).

Pathogenic Leptospira are pathogens that dwell in the kidneys of their natural hosts, primarily mammals, and are discharged into the environment with the urine. Under the right environmental circumstances, they can survive for several months. Like, exposure to infected animals, their urine, or a urine-contaminated environment can cause infection (mostly mud and water). The mucous membranes and open skin are the entry points for infection. Numerous sylvatic and domestic animals act as a reservoir for Leptospira, which is widely identified in a variety of animal species. Leptospirosis is a human infection brought on by L. interrogans, of which there are more than 200 identified pathogenic serovars and many routes of transmission (Pal and Hadush, 2017).

Humans are considered accidental hosts of Leptospira whereas animals are called reservoir hosts. Leptospirosis has a wide range of clinical symptoms and is brought on by recreational contact with water polluted with Leptospira. Leptospirosis is diagnosed based on the sample's accessibility and the disease's temporal stage. Laboratory tests used to find leptospira include molecular techniques, serology, culture, microscopy examination, and animal inoculation (Ahmad et al., 2005). Medications like tetracycline, penicillin, ampicillin, doxycycline, streptomycin, and erythromycin are used to treat leptospirosis (Heymann, 2008).

Leptospirosis control measures are intended to reduce the occurrence of clinical disease based on integrated actions in several links of the transmission in order to reduce the risk of infection resulting from contact with contaminated environments, infected wild animals, as well as with synanthropic animals and rodents (Tilahun et al., 2013). Leptospirosis is a largely obscure illness in Ethiopia. Therefore, the goals of this work were to provide an one health implication of leptospirosis significance that affects both animals and people.

2. LITERATURE OF LEPTOSPIROSIS:

2.1. Etiology

Leptospirosis is caused by spirochaetes from the genus Leptospira which currently contains 20 species containing nine pathogenic, six saprophytic, and five intermediate species (Sarah et al., 2014). These spirochaetes are finely coiled, thin, motile, obligate, slow-growing aerobes. Leptospirosis are gram-negative but silver staining and immune staining techniques which can offer better results and can be useful for post-mortem diagnosis using fixed or unfixed tissues (Smythe et al., 2013). The morphology of Leptospirosis is corkscrew-shaped bacteria, which differ from other spirochaetes by the presence of end hooks. Leptospirosis have two or more axial filaments that are responsible for the motion of the spirochete, and are visualized under dark field microscopy (Devishree, 2015). The spirochete L. interrogans has 20 serogroups and more than 280 serovars (Pal, 2007).

Nearly all mammalian species have pathogenic spirochaetes of the genus Leptospira, which cause leptospirosis (Himani et al., 2013). The genus Leptospira is separated into two species: L. interrogans, which includes all pathogenic strains, and L. biflexa, which includes saprophytic strains isolated from the environment. It is a member of the Order Spirochaetes, Family Leptospiraceae, and Class Spirochaetes (Sharma and Yadav, 2008). Pathogenic leptospirosis are invasive, highly mobile spirochetes with the ability to proliferate and live in tissue by evading host defenses. Serovar Pomona, Canicola, Bratislava, Graphityphosa, Hardjo, and Interohemorrhagie are frequent serovars of L. interrogans (Radostits et al., 2007). There are two types of hosts for the leptospirosis agent: accidental hosts and maintenance hosts. Animals infected with the organism's adapted serovar are known as maintenance or reservoir hosts, while incidental or accidental hosts are created when vulnerable animals are exposed to serovars that are not adapted to the host (Yadeta, 2016). Leptospira differs morphologically from other spirochete bacteria in that they have distinctive hooked ends and are tightly coiled (Figure 1).

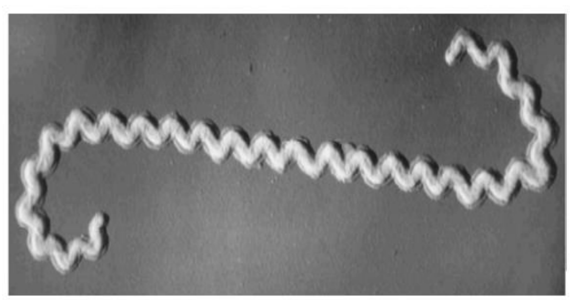

Figure 1: Leptospira species showing characteristic helical shape, periplasmic flagella and outer membrane.

2.2. Phylogeny of Leptospira:

Once within the body, the bacterium travels through lymphatic capillaries to the bloodstream (Adler and Moctezuma, 2010). The germs will multiply in the bloodstream and move to some organs, including the kidneys, spleen, liver, eyes, and reproductive organs. There are three probable paths after systemic circulation. The body will be free of leptospires and no clinical symptoms will be present if the animal has a high and sufficient antibody titer. A modest or brief leptospiremia can be present in an animal with a significant antibody, which is then followed by mild clinical symptoms. After the leptospires have been removed through the kidneys, the animal will stop shedding leptospires. Leptospires will multiply in the bloodstream if the animal has a low or absent antibody titer, which causes persistent shedding of leptospires in particular, in the urine for days to months, even years (Greene et al., 2006).

Pathogenesis of the bacterium enters the body through intact mucous membranes (mouth, nose, eyes, and vagina) or a skin with lesions and scratches (Adler and Moctezuma, 2010). They multiply rapidly after entering the vascular system, spread and further replicate in many tissues including kidney, liver, spleen, central nervous system, eye and genital tract. The Extend of internal organ damage is available depending on the virulence of the organism and host susceptibility (Craig et al., 2006). In most infected animals, renal colonization occurs because the organism replicates and persists in renal tubular epithelial cells, even in the presence of serum neutralizing antibodies; the organism may be seen within the proximal tubular cells which coincides with the onset of shedding (Radostits et al., 2007). The known virulence factors of Leptospira include Lipopolysaccharide (LPS) (a general virulence factor of Gram-negative bacteria), flagella, heme-oxygenase, the OmpA-like Loa22, and adhesion molecules. In addition, hemolysins and sphingomyelinases may play a role during infection (Narayanavari et al., 2012). Human susceptibility to leptospirosis may be related to poor recognition of Leptospira LPS by the innate immune system (Werts et al., 2001). Human toll-like receptor (TLR), which responds to extremely low concentrations of gram-negative LPS (endotoxin), appears to be unable to bind Leptospiral LPS perhaps because of the unique methylated phosphate residue of its lipid A (Nahori et al., 2005). The incubation period of leptospirosis depends on a dose, infectious strain and host but is averagely between 7-14 days. Antibodies become detectable 5-7 days after infection (Sykes et al., 2011). It takes about two weeks for the leptospirosis to reach the proximal tubular cells and the tubular lumen in the kidneys (Petrakovsky et al., 2014). In some animals such as rodent: brown rat, despite an increased antibody titer, the bacteria can replicate and persist in the renal tubular cells. This may result in chronic shedding of leptospirosis in the urine for days to months and even years (Langston and Heuter, 2003).

2.3. Epidemiology of Leptospirosis

2.3.1. Host range and distributions

All mammalian species are susceptible to leptospirosis infection; however, cats are less likely to contract the disease than are cattle, sheep, goats, dogs, horses, and pigs (Levett. 2001). Although it is widespread around the world, it is most prevalent in warm, developing nations where it is more probable that people will come into touch with diseased animals or water that has been tainted by their urine (Ko et al., 2009). When the surrounding temperature is warm, Leptospira can thrive in muck, surface water, moist soil, and ponds, rivers, and other water bodies.

Interohaemorrhagiae, L. canicola, L. pomonai, L. hardijo, and L. gripotyphosa serovars are present on all continents, and outbreaks have been linked to natural disasters such flooding and hurricanes (WHO, 2003). Variations in soil and water conditions in contaminated areas are crucial for an organism's survival in its environment. Drying and pH values between 6 and 8 can make the organism vulnerable. The life of the organism is harmed by ambient temperatures around 7.1 °C or below 34 °C (Radiostats et al., 2007).

2.3.2. Transmission of the disease

Contact with urine or other bodily fluids containing live Leptospira can result in the direct or indirect transmission of leptospirosis from one carrier animal to another healthy animal. Depending on the virulence of the organism and host, congenital transmission is potentially a possibility. For several weeks after birth, a live, infected neonate might harbor the virus and serve as a source of infection. There have also been reports of sexual transmission in rats, pigs, and dogs. Although it is uncommon, transmission can occur through natural breeding or artificial insemination (Radiostats et al., 2007). Humans can contract the virus by direct contact with infected animal tissues, consumption of tainted food and water, sexual contact, trans-placental transmission from an infected mother to her fetus, and breastfeeding (WHO, 2003).

2.4. Leptospirosis in animals

Leptospirosis can affect animals of any age; however young animals are more sensitive to the illness than adult animals are. Access to contaminated water sources, such as streams, rivers, floodwater, or drainage water, as well as obtaining or borrowing diseased male animals for natural insemination are some management practices that increase the risk of infection (Radostits et al., 2007). Leptospirosis is frequently referred to as a seasonal disease because it mostly affects temperate regions throughout the summer and fall. The peak incidence occurs during the rainy season in tropical climates (Adler and Moctezuma, 2010).

Leptospirosis is characterized by a broad range of clinical symptoms in livestock with minor difference between species affected: Clinical signs of acute or sub-acute disease are observed in the leptospiremic phase and is characterized by septicemia, high fever, anorexia, and petechiation of mucosa, depression and acute hemolytic anemia with a haemoglobinuria, jaundice and pallor of the mucosa (Petrakovsky et al., 2014). Chronic infections are usually associated with reproductive losses through abortion, stillbirth, infertility and mastitis and milk drop syndrome. Abortion is common during the last trimester of pregnancy (Radostits et al., 2007). Although, other nonspecific signs are common, anorexia, lethargy and vomiting were the three most common clinical signs in dogs with leptospirosis (Greenlee et al., 2004). In equine, severe forms of the disease is characterized by conjunctiva suffusion, jaundice, anemia, petechial haemorrhages on the mucosa and general depression. In foal’s renal failure and in pregnant mares, placentitis, abortion and stillbirths may also present (Verma et al., 2013). Infertility and milk drop occurs only in pregnant or lactating cows because Leptospira organisms require pregnant uterus and lactating mammary gland to proliferate. Sudden drop in milk production may affect up to 50% of cows at one time and precipitate fall in the herds milk yield, the decline may last for up to 8 weeks but individual cow milk production will return to normal within 1-14 days (Radostits et al., 2006).

2.4.1. The role of rodent

Leptospirosis spread by rodents is a significant factor. They may excrete up to 100 million leptospirosis in the urine, which can contaminate water, soil, and food. As a result, they are one of the main sources of human infection (Pal, 2007). It is believed that these reservoirs serve as a source of infection for domesticated animals and people, who may subsequently infect additional animals and people. The presence of rodents in developing nations could serve as a reservoir for human infection (Guerra and M, 2013). Human illness has also been brought on by contact with adopted wild rodents in wealthy nations. Rodents are the main host responsible for transmitting leptospirosis to people in urban and rural slum areas (Baer et al., 2010).

Many species of murine rodents have been recorded as carriers of this pathogen around the world. Due to their wide distribution and high abundance in rural areas with Feral and peridomestic rodents are thought to be the most significant reservoirs in farmlands and in cities with high human population density (Gamage et al., 2014). This is supported by the numerous cases of human and animal leptospirosis that have been linked to rats in more than 40 different nations (Mathias and Levett, 2002; Koutis, 2007).

Interohaemorrhagiae is the most common serogroup despite the fact that numerous strains and serovars are involved in human cases, highlighting the significance of rodents as a significant reservoir (Perez and Goarant, 2010). It is thought that people contract it from the commensal brown rat (Rattus norvegicus), which is intimately associated with human activities (Brown and Prescott, 2008). Rats can infiltrate houses, factories, and other buildings through broken sewers and come into touch with food, among other things, putting humans at risk of contracting Leptospira (Mayer, 2004). Although data on actual disease prevalence in rodents and humans, and their environmental and socioeconomic correlates, are very scarce globally for both rural and urban communities, as shown in Figure 3 below, it would be expected that close proximity of rodents to humans and their food supplies, as well as high rodent densities, would result in potential disease epidemics (Singleton et al., 2003).

2.4.2. Factor that increases rodent infestation

Climate and season: winter is associated with increased rat related complaints as rat moves indoor to seek shelter. Increase growth rate in urban rat may be higher in winter, which may attribute to decreased competition (increased access to food) from an overall reduced population size during winter, and decreased decomposition of garbage from colder ambient temperature (Feng and Himsworth, 2014). Environmental drivers interplaying by changes in climate, and certain anthropogenic factors, have been demonstrated to lead to incidences of leptospirosis in many parts of the world. For instance, higher than normal rainfall and extreme weather events are natural disasters that can cause a rise in rodent populations. This is due to the scattering of debris and garbage, interference of sewerage systems as well as the increased growth of vegetation leading to increased food availability. Flood waters that drive reservoir animals out of their habitats can lead them to move to human populations and increase human-animal contact. This can ephemerally lead to increased transmission of the disease (Lau et al., 2010). On the other hand, a decrease in rainfall can also increase the human-to animal contact by reducing the water available on the surface as well as forcing rodents into human habitations in order to forage for food (Cook et al., 2008).

Availability of food and harborage: Availability of food source influences the abundance of rats. Improperly stored or disposed food and organic waste, disheveled gardens, and presence of domestic animal (dogs, cats, pets, livestock) in residences, gardens or city block are correlated with rat infestation. Availability harborage determines whether the population becomes established. Any structure that is easily accessible and abandoned may act as a source of infestation. Accessibility to shelter such as holes/crack in roof, wall, ceiling, and building foundation, access point near utility line and sewer systems, and particularly abandoned structures are associated with rat infestations. This is particularly the case with older aged housing and aging of community infrastructure such as defective drains. Defect in sewer system and inadequate sewer baiting also contribute to surface infestations (Michelle et al., 2016). Higher housing density is possibly associated with urban rodent infestations because the dispersal and colonization of one home can affect surrounding dwellings. Rats are more likely to disperse successfully over short distances. Impoverished neighborhoods are excessively affected by rat infestations. Suitable harborage and food source for rats tend to be most abundant in neighborhoods of lower socioeconomic status, where properties may be aging dilapidated and abandoned, and public services including waste disposal may be inadequate, leading to unhygienic environments that could be a source of food (Feng and Himsworth, 2014; Michelle et al., 2016).

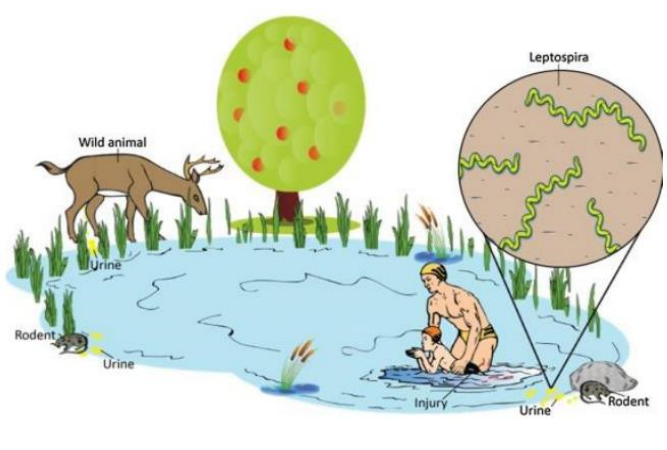

Figure 2: The schematic diagram explaining the role of rodent transmission of Leptospira.

2.5. Public health significance of leptospirosis

In humans, more than 500,000 estimated cases of severe leptospirosis are reported annually, with case fatality rate exceeding 10% (Bharti et al., 2003; Tilahun et al., 2013).

2.5.1. Mode of transmission in human

The main sources of infection for the incidence of disease are urine of infected or carrier animals, contaminated surface water, mud, feed, soil, aborted fetuses and uterine discharges (Levett, 2001). From these sources, the organism enters the body via mucous membranes of the eyes, mouth, nose, vagina, or leptospirosis penetrate through small and sometimes invisible abrasions in the skin (Thayaparan et al., 2013). Modes of transmission of leptospirosis are often categorized as direct or indirect depending on the immediate source of infection. Transmission is direct if the immediate source of infection is animal tissue, body fluids, urine, transplacental, or venereal, whereas immediate source of infection is an environment contaminated with urine of carrier animals and is indirect (Pal, 2012). Contact with rodents and water sources are significant factors, particularly in flood periods. Transmission between humans are very rare and it occurs through blood transfusion, organ transplantation, breast feeding and sexual intercourse (Johnson et al., 2004). Leptospirosis affects risk groups that are exposed to animal reservoirs or contaminated environments, such as abattoir and sewage workers, salver workers, coal mines, plumbers, farm workers, trappers, veterinarians, pet shop owners, meat handlers, military personnel, laboratory workers, and workers in fishing industry (Katz et al., 2002). Recreational activities that increase the risk of leptospirosis are gardening and water sports such as canoeing, kayaking, swimming and white water rafting residents of some urban areas (Radostits et al., 2007). Household exposure with in pet dogs, domesticated livestock, rainwater catchment systems, infestation by infected rodents. And also walking barefoot through surface water, skin lesions, contact with wild rodents, accidental laboratory exposure (Wasinski and Dutkiewicz, 2013). Leptospirosis is diagnosed in men more often than in women, and this has generally been linked to the prevalence of men in high-risk occupational groups (Pavli and Helena, 2008). Contact with rodents and water sources, particularly during times of flooding, are significant concerns Figure 2. Human-to-human transmissions are extremely uncommon and can happen through sexual activity, breast-feeding, organ transplantation, blood transfusions, and organ donation (Johnson et al., 2004).

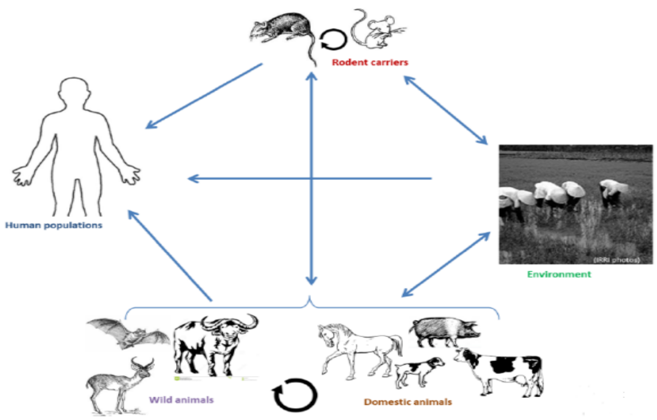

Figure 3: The Transmission cycle of leptospirosis considering the environment, rodent hosts, domestic and wild animals and human beings.

2.5.2. Clinical sign in human

The incubation period in humans is usually 7 to 12 days, with a range of 2 to 29 days (Ko et al., 2009). Human infections vary from asymptomatic to severe, while the classic presentation is a biphasic illness, leptospirosis can occur in many forms, which include mild, flu-like cases that may not be recognized as leptospirosis, as well as unusual syndrome or progressive fulminant illness without two distinct phases (Pavli and Helena, 2008). The first stage of the classical biphasic illness is called the acute or septicemic phase. It usually begins abruptly, and is characterized by nonspecific signs such as fever, chills, headache and conjunctival suffusion (Murray et al., 2002). Myalgia, which typically affects the back, thighs or calves, is often severe. Some patients also have other signs, such as weakness, photophobia, lymphadenopathy, abdominal pain, nausea, vomiting, a transient rash, sore throat, and coughing or chest pain. The phase last for 3 to 7 days (Peter and Narasimha, 2011). The second stage is called the "immune phase" because anti leptospiral antibodies develop at this time followed by septicemic phase after 3-4 days (WHO, 2003; Hartskeerl et al., 2006). Patients in the second stage of leptospirosis develop either anicteric or icteric disease. This syndrome is characterized by a severe headache, stiff neck and other meningeal symptoms, and typically lasts a few days. The anicteric form is more common and less severe (Bharti et al., 2003). Icteric leptospirosis is more sever also known as Weil disease. It occurs in 5–10% of all patients, is often rapidly progressive, and may be associated with multiorgan failure (Pavli and Helena, 2008). In this form, there may be no period of improvement between the septicemic and immune phases. The most commonly involved organ systems are the liver, kidneys and central nervous system. Jaundice can be severe and may give the skin an orange tone, and acute renal failure occurs in a significant number of cases. Some patients also have hemorrhages of varying severity, from petechiae and epistaxis to severe bleeding in the gastrointestinal tract and other organs. Some cases of icteric leptospirosis are fatal, and convalescence may be prolonged (Katz et al., 2002). A severe pulmonary form of leptospirosis occurs in less than 5% of symptomatic patients, but has been an important cause of death in some recent outbreaks. It can be seen in both the anicteric and icteric forms, and usually appears on the 4th to 6th day of illness. It is characterized by pulmonary hemorrhage and edema, with dyspnea and hemoptysis, and can be rapidly fatal (Levett, 2001). Up to 10% of leptospirosis patients develop anterior or diffuse uveitis, a few weeks to a year after recovery. The severity of this condition varies, and the inflammation may be acute or recurrent. It usually has a good prognosis, when treated, and some cases may be self-limiting (Radostits et al., 2007).

3. Diagnosis of leptospirosis

3.1. Direct microscopy

Leptospires may be seen on microscopic evaluation of blood, urine, CSF and peritoneal or pleural exudate during the first 10 days of the infection. Dark field microscopy is required as the leptospires are very small, however more than 10000 organisms/ml are required to be able to see them (Zuerner, 2010). The method of direct examination by using dark field microscopy is limited to urine because other body fluids contain artefacts similar to Leptospira organism and the method has both low sensitivity (40.2%) and specificity (61.5%) (Vijayachari et al., 2001). A range of staining methods has been applied to direct detection, including immune fluorescence staining, immune peroxidase staining, and silver staining. These methods are not widely used because they lack commercially available reagents and their relatively low sensitivity (Slack et al., 2007).

3.2. Isolation and identification

For the first 7 to 10 days, like an infection, the bacteria can be found in the blood and cerebrospinal fluid (CSF), before spreading to the kidneys. Due to the wide variety of symptoms, the microorganism can be detected in fresh urine after 7 to 10 days; however, due to early diagnostic efforts, such as isolation from blood or other clinical materials through culture of pathogenic leptospira (Craig et al., 2009). It is also difficult to isolate Leptospira from patient samples; the organisms often take 1-2 weeks. Isolation of the microorganism from fetal tissue (kidney, liver, lungs) confirms maternal infection (Adler and Moctezuma, 2010). Isolation requires expensive and properly prepared and kept culture media. Inoculated media are incubated at 28-30°C for several weeks or months (Ko et al., 2009). Cultures are performed in albuminpolysorbate media such as Ellinghausen-McCulloughJohnson-Harris (EMJH) medium, which is available commercially. Older media contained serum (WHO, 2003). Primary cultures are performed in semisolid medium, to which 5-fluorouracil is usually added as a selective agent.

3.3. Molecular technique

DNA amplification using PCR and DNA primers have become an excellent diagnostic tool for detecting the presence of Leptospira in animal tissues and fluids and it can be applied to blood, urine, CSF and tissue samples anti or post mortem (Levett, 2003). The chief advantage of PCR is the prospect of confirming the diagnosis during the early acute (leptospiremic) stage of the illness, before the appearance of immunoglobulin M (IgM) antibodies, when treatment is likely to have the greatest benefit. In fulminating cases, in which death occurs before seroconversion, PCR may be of great diagnostic value (Boonsilp et al., 2011).

3.4. Serological methods

Macroscopic and microscopic agglutination tests, complement fixation test and ELISA technique are used for the detection of leptospirae in serum. The macroscopic agglutination examination is a screening test that uses dead Ag but suffers from specificity (Hirsh et al., 2004). Microscopic Agglutination Test (MAT) is the standard method for the serological diagnosis of leptospirosis. To execute MAT, leptospires are grown in liquid media and used alive. Serum is mixed with this live liquid grown leptospires in order to test for agglutination. Agglutination indicates that the serum contains anti-leptospiral antibodies (Sykes et al., 2011). As the leptospires are thin and small, dark field microscopy is used to evaluate the agglutination. Agglutinating antibodies are most frequently IgM and to a lesser extent IgG (Adler and Moctezuma, 2010). Enzyme linked immuno sorbent assay (ELISA) test of leptospirosis can be performed either by using commercial kits or within house produced antigen. A broadly reactive so-called genus-specific antigen is generally used to detect IgM and sometimes also IgG antibodies against leptospiral antigen. The presence of IgM antibodies indicates current or recent leptospirosis (Brown and Prescott, 2008). Common commercially-available Leptospira IgM ELISA is used to serologically detect acute leptospiral infections in patient serum samples. This ELISA works on the principle that any Leptospira IgM antibodies present in patient serum will bind to the leptospiral antigen attached to the polystyrene surface of the micro wells (Pal, 2007; Heymann, 2004). The ELISA test is more accurate than other tests and has much advantage from the point of view of laboratory practises. It has excellent diagnostic specificity and sensitivity, convenient technical feature including automation and can be used efficiently as serenity test for large number of serum samples (Hirsh et al., 2004).

4. Control and Prevention

Due to the disease's resistance to routine laboratory tests, leptospirosis has been a disease that has been underreported, and there are just a few accurate global incidence figures. Leptospirosis is extremely difficult to find in a population. Although avoiding contact with potentially infected animals or water tainted with animal urine can considerably reduce the incidence of leptospirosis. Workers should wear protective gear or footwear, just like in their occupations. While swimming in fresh water, any skin cuts should be treated with a waterproof covering to guard against a variety of illnesses. Human immunization helps to provide a certain level of protection against illness in companion dogs, providing both the animal and the home with some degree of protection from the germs (Hyodoh et al., 2005).

Given the prevalence of rodent species that act as infection reservoirs, the disease's total eradication appears to be impractical. Therefore, understanding the epidemiology and transmission mechanisms of leptospirosis is essential to developing effective preventative methods. By limiting exposure and putting preventative measures, vaccinations, and pre- or post-exposure chemoprophylaxis into place, the disease can be avoided. The danger of infection is significantly decreased by housing construction that keeps rodents out of water sources and residential living areas. Avoid swimming in hazardous water and going barefoot through floodwaters. The choice of animal relocation must take into account the herds' lack of leptospirosis responsiveness. Due to serovar-specific immunity and the fact that vaccines only provide protection against the serovars covered by the immunogens, leptospirosis vaccines for domestic animals are only able to reduce the severity of the disease (Yadeta et al., 2016).

5. Status of leptospirosis in Ethiopia

In Ethiopia, although climatic condition, socioeconomic and other factors are highly favorable for the occurrence and spreading of the disease, few information's are available about leptospirosis in animals and humans. Rodents may be a significant reservoir of leptospirosis as they are in other areas of the world. In the case of human leptospirosis, there is a pilot study in Wonji Hospital. According to the study from a total of 59 febrile patients attending the outpatient department of Wonji Hospital, 47.46% of the patients were positive for leptospirosis and the occurrence of the disease was more common in males than females (Eshetu et al., 2004). Seropositivity has been demonstrated in domestic animals working in Ethiopia by Moch et al. (1975), found incidences of 91.2% in horses, 70.7% in cows, 57.1% in pigs, 47.3% in goats, 43.4% in sheep, 15.4% in camels and 8.3% in dogs (Moch et al., 1975). A total of 184 out of 418 horses had antibody titers of 1:100 or greater to at least one of 16 serovars, demonstrating the presence of 16 serovars of Leptospira species in Central and Southern Ethiopian horses. This means, 44% of the sampled horses were seropositive to at least one serovar. The significant risk factor associated with Leptospira seropositive horses were drinking river water and the presence of dogs in adjacent neighboring properties. Dog had a protective effect against seropositivity to serovars Bratislava and Djasiman, which may be due to their ability to control rodents (Tsegay et al., 2016).

6. Conclusion and Recommendation:

The most prevalent and pathogenic Leptospirosis interrogans are the cause of leptospirosis, the most prevalent zoonotic disease of worldwide significance. Leptospira is unique among the spirochetes. Humans and animals are both affected by it. Although skin abrasions and the urine of sick animals tend to propagate the germs. In animals like rats and mice, the bacteria enter the body through minute wounds, mucosa, conjunctiva, and vaginal tracts. Natural hosts, primarily mammals, have kidneys where pathogenic Leptospira thrives and is discharged into the environment with urine. Where it can endure under ideal circumstances for a number of months. Leptospirosis can be effectively treated with antibiotics, and current immunization programs for domestic animals can lessen the severity of the condition.

Consequently, Ethiopia and other African countries lack the understanding on leptospirosis. Leptospirosis is a highly contagious disease that can affect humans and animals that are susceptible. Therefore, it is best to prevent getting urine on cuts or mucous membranes. Protective gear, including as gloves, eye protection, and face masks, should be worn when handling contaminated objects or animals. Although, most antibiotics are effective in treating it. Diagnosing leptospirosis is simple using microscopy, culture, serological and PCR methods. The following points are offered as recommendations in light of the aforementioned conclusion.

- Applying effective control measures and raising public awareness of leptospirosis zoonotic transmission is advised.
- Additionally, collaboration in the fields of environmental, animal, and human health should be used to strength one Health.
- Since there are currently so few findings that have been reported, more studies on the prevalence and incidence of leptospirosis in Ethiopia are needed.
- In order to protect themselves from animal reservoirs and contaminated settings, communities at risk should wear protective gloves.

Conflict of Interest:

The authors declare that they have no conflicts of interest.

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