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Advancing for diagnoses of brucellosis and therapeutic approach in Ethiopia

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Summary: - Brucellosis is considered to be one of the most widespread zoonoses in the world. According to OIE. it is the second most important zoonotic disease in the world after rabies. The disease affects cattle, swine, sheep, goats, camels and dogs. It may also infect other ruminants and marine mammals. The disease is manifested by late term abortions; weak calves, still births; infertility and characteristic lesions are primarily placentitis, epididymitis and orchitis. The organism is excreted in uterine discharges and milk. The disease is economically important,and one of the most devastating trans boundary animal diseases and also a major trade barrier. Although not yet reported, some species of Brucella (e.g., B. abortus) are zoonotic and could be used as bioweapons. Brucellosis has a considerable impact on animal and human health, as well as wide socio-economic impacts, especially in countries in which rural income relies largely on livestock breeding and dairy products. Considering the poor health infrastructure and manpower in rural areas, the focus should be on preventive measures coupled with strengthening the curative health care services for early diagnosis and treatment. The incidence of brucellosis is increasing particularly in large dairy herds in Pakistan. Several studies have been conducted using serodiagnostic techniques to determine the prevalence of brucellosis in different provinces, districts and livestock farms in government and private sector.

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Key words: *Brucellosis, Brucella, cattle, zoonosis*

1. Introduction

Brucellosis is considered by the Food and Agriculture Organisation (FAO), the World Health Organisation (WHO) and the Office International des Epizooties (OIE) as one of the most widespread zoonoses in the world (Schelling *et al.,* 2003). According to OIE, it is the second most important zoonotic disease in the world after rabies. The disease affects cattle, swine, sheep, goats, camels and dogs. It may also infect other ruminants and marine mammals. Synonyms of Brucellosis include: undulant fever, Malta fever, Mediterranean fever, enzootic abortion, epizootic abortion, contagious abortion, and Bang's disease. It is an important zoonotic disease and causes significant reproductive losses in sexually mature animals (Wadood *et al.,* 2009). The disease is manifested by late term abortions, weak calves, still births, infertility characterized mainly by placentitis, epididymitis and orchitis, with excretion of the organisms in uterine discharges and milk (England *et al.,* 2004).

It also causes morbidity and considerable loss of productivity (Pappas, 2006). The disease is important from economic point of view; it is one of the most devastating trans-boundary animal diseases and also a major barrier for trade (Gul and Khan, 2007).
Human-beings are on the island of Malta in the $_{19}^{th}$ and early 20^{th} centuries. It represents a cause of health problems in a herd. In addition to its direct effects on animals, brucellosis causes economic losses through abortions, stillbirths or the death of young stock. The disease can also have a blow on exports and have negative impact on the efforts to improve breeding. Brucellosis has a considerable impact on animal and human health, as well as wide socio-economic impacts, especially in countries in which rural income relies largely on livestock breeding and dairy products (Maadi *et al*., 2011).

Considering the poor health infrastructure and manpower in rural areas, the focus should be on preventive measure together with strengthening the curative health care services for early diagnosis and treatment. Measures against brucellosis should aim at the control and, if possible, the eradication of the agent in the animal reservoir. As the disease often goes undetected the identification of infected herds and animals is of prime importance (Aulakh *et al*. 2008) showed that brucellosis is widespread in cattle and buffaloes and the only alternative to control and eradicate the disease is a statutory mass vaccination of livestock.

Zoonotic importance: In humans, brucellosis can be caused by B. abortus, B. melitensis, B. suis biovars 1-4 and, rarely, B. canis. From public health view point, brucellosis is considered to be an occupational disease that mainly affects farm labor, slaughter-house workers, butchers, veterinarians (Yagupsky and Baron, 2005). Transmission typically occurs through contact with infected animals, materials with skin abrasions, inhalation of aerosols or ingestion of contaminated or unpasteurized dairy and food products (Young, 1998; Christopher *et al.,* 2010).

Worldwide prevalence of brucellosis in human population has been studied and reviewed. The Mediterranean Basin, south and Central America, Eastern Europe, Asia, Africa, the Caribbean and the Middle East are considered as high-risk countries. In the Eastern Mediterranean Region, the incidence of disease ranges from 1 per 100,000 to 20 per 100,000 populations. Brucellosis is endemic in Saudi Arabia, where the national sero-prevalence is 15% (Memish, 2001).

Brucellosis is also a public health problem in Pakistan by conducting a sero-prevalence study of brucellosis in abattoir workers. Symptoms in human brucellosis can be highly variable, ranging from non–specific, flu-like symptoms (acute form) to undulant fever which may progress to a more chronic form and can also produce serious complications affecting the musculoskeletal, cardiovascular, and central nervous systems, other problems like arthritis, orchitis and epididymitis. It also gives rise to a chronic granulomatous infection, causing clinical morbidity that requires combined prolonged antibiotic treatment Grillo *et al.,* 2006). Human incidence of brucellosis can only be controlled by decreasing the incidence of disease in animals, especially livestock species. It is a serious public health challenge having socio-economic problems and an unaccounted financial burden which needs joint efforts, promotion of Inter-sectoral action, regional and international cooperation, as well as technical and financial support (Baba *et al.,* 2001).Therefore th**e** objective of this paper is**:**

To review the current status of the disease, the mechanism of infection, and pathogenesis, its zoonotic potential, diagnostic advances, treatment regimens, and the preventive measures.

1.1. Etiology

Brucellosis is caused by infection with Gram-negative bacilli of the genus Brucella. The genus encompasses 10 recognized species including three species that are of major public health and economic importance (Corbel, 2006). These are B. melitensis which predominantly infects sheep and goats, B. abortus which affects cattle, and B. suis, which affects swine (Corbel, 2006). These species may also infect camelids, jacks and a variety of wildlife species. B. melitensis, B. abortus, and B. suis can be further sub-divided into biovars based on the unique phenotypic characteristics of different strains. Subspecies differentiation according to genotype is also possible using molecular tools for the analysis of the genetic structure of strains that have been isolated (Armon *et al,* 2001).

1.2. Epidemiology

The epidemiology of brucellosis is complex. The important factors that could contribute to the occurrence and spread in livestock include, farming system and practice, farm sanitation, live stock movement, sharing of grazing lands and moderate changes towards identification (Kadiohire *et al,* 1997*).*
Global Perspective: Brucellosis occurs worldwide in domestic and game animals .Brucellosis has been eradicated from most industrialized countries such as in Finland, Norway, Sweden, Denmark, Germany, Australia, and Netherland (Acha and Szyfers, 2001).

In other part of the world the rates of brucellosis caused by B. abortus vary greatly from one country to another and between regions with in a country. The highest prevalence is noticed in dairy cattle (Quinn *et al*, 1994).

Even highly developed countries like USA and France have so far not been able to eradicate brucellosis completely. Brucellosis caused by B. melitensis occurs in sheep and goat raising regions of the world with exception of North America, Australia and Newzealand. B. suis infection also occurs worldwide (Walker, 1999 and Quinn *et al*, 1994). Brucellosis is an important livestock disease in many African countries (Walker, 1999). The incidence of infection up to 80% can be found in intensive dairy production systems of the tropics. The extensive animal production systems of average diseases incidence of 25 -30% has been calculated. In eastern Sudan an infection rate in cattle of almost 22% and in sheep about 13.6% was found (Seifert, 1996).

1.3. Transmission

Chronically infected cattle may shed the organism via milk and reproductive tract discharges (Neilson 2006 ,Abubakar *et al* ,2010 and Nikokar *et ,al* 2011) , and can also vertically transmit infection to their new born calves, thereby continuing the transmission of the disease (Corbel, 2006, Bataineh, 2007;andKato *et al* 2007). Aborted fetuses from infected animals contain huge numbers of infectious organisms, and if not properly disposed of they form a major source of contamination (Shang *et al,* 2002, Shang *et al,* 2007). The pathogen is highly contagious and is easily spread by licking the infected, aborted materials, discharges and waste of infected animals (Shang *et al,* 2002 Muma *et al,* 2006 and Matope *et al* 2010*)* Direct contact with infected animals and consumption of contaminated dairy products may cause infection in human beings (Olsen and Tatum, 2010 and Ducrotoy,2014)

Human to human transmission is relatively uncommon (Mantur *et al,* 1996) ; however, it had been reported to occur after bone marrow transplantation (Erten *et al,* 2006), sexual intercourse (Mantur *et al,* 1996) and blood transfusions (Economidou *et al* 1976) . Animals are often housed in unhygienic sheds with poor management systems and also in close association with each other some sharing the same buildings. This presents a significant risk for the contraction of brucellosis in humans. Similarly, the consumption of raw milk, liver, spleen, udder, kidney, testis as well as handling of dung, is widely prevalent (Arena *et al*, 2000).

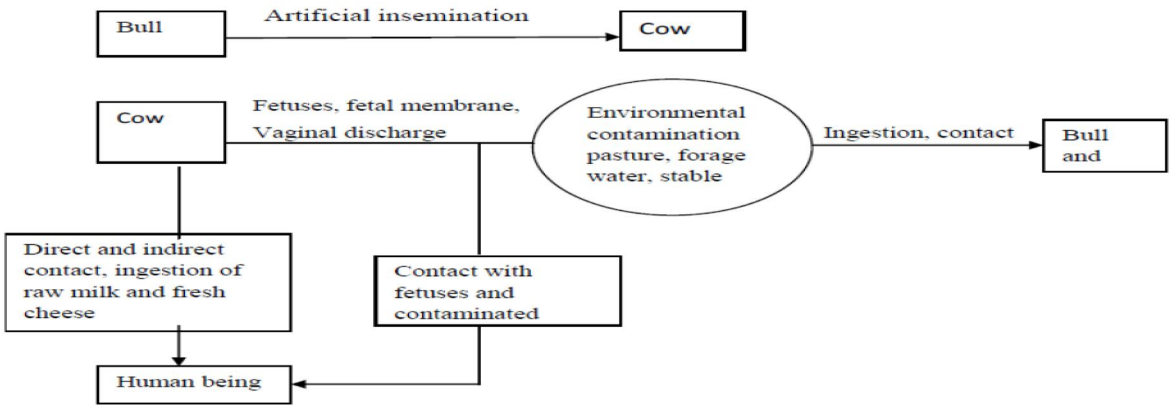

Figure 1: Mode of transmission of bovine brucellosis (B. abortus)

Source: Acha and Szyfres (2001).

1.4. Risk Factors

1.4.1. Animal risk factors:

Susceptibility of cattle to B. abortus infection is influenced by the age, sex and reproductive status of the individual animal. Sexually mature pregnant cattle are more susceptible to infection with the organism than sexually immature cattle of either sex. Susceptibility increases as stage of gestation increases. B. melitensis which predominantly infects sheep and goats, B. suis, which affects swine (Radostits *et al*, 2006).

1.4.2. Pathogen risk factor:

B. abortus, B. melitensis, B. suis, *B ovis are* a facultative intracellular organism capable of multiplication and survival within the host phagosome. The organisms are phagocytised by polymorphonuclar leucocytes in which some survive and multiply. The organism is able to survive within macrophages because; it has the ability to survive phagolysosome. The bacterium possesses an unconvenential non-endotoxin lipopolysaccaride, which confers resistance to antimicrobial attacks and modulates the host immune response. These properties make lipopolysaccharide an important virulence factor for Brucella survival and replication in the host (Radostits, 2006).

1.4.3. Occupational risk factors**:**

Laboratory workers handling Brucella cultures are at high risk of acquiring brucellosis trough accidents, aresolization and/or inadequate laboratory procedures. In addition to this, abattoir workers, farmers and veterinarians are at high risk of acquiring the infection (Colibaliy and Yamego, 2000 and Radostits *et al,* 2006).

1.4.4. Managemental risk factors:

The spread of the disease from one herd to the other and from one area to another is almost always due to the movement of an infected animal from infected herd in to a non infected susceptible herd., Herds located close to other infected herds and those herds whose owners made frequent purchase of cattle had an increase risk of acquiring brucellosis. Once infected, the time required to become free of brucellosis was increased by large herd size, active abortion and by loss housing (Radostits *et al,* 2006).

1.5. Pathogenesis

Brucellosis has predilection in the pregnant uterus, udder, testicle and accessory male sex glands, lymphnodes, joint capsule and bursa. After initial invasion of the body, localization occurs initially in the lymph nodes. Brucellosis is phogocytized by macrophages and neutrophils in an effort by the host to eliminate the organism. However, once inside phagocyte, Brucellosis is able to survive and replicate. The phagocyte migrates via the lymphatic system to the draining lymph node where Brucella infection causes cell lysis and eventual lymph node hemorrhage 2-3 weeks following exposure. Because of vascular injury some of the bacteria inter to the blood streams and subsequent bacteremia occurs, which disseminates the pathogen throughout the body. If the infected animals are pregnant, Brucellosis will colonize and replicate in high number in the chrionic trophoblasts of the developing fetus. The resulting tissue necrosis of the fetal membrane follows transmission of bacteria to the fetus. The net effect of chorionic and fetal colonization is abortion during the last trimester of pregnancy (Radostits *et al* ,2006).

Sexually immature and other non pregnant animal can become infected but lose their hormonal antibody to the organism much more quickly than anmal infected while pregnant. In the adult non pregnant animal, localization occurs in udder and uterus, if it becomes gravid, is infected bactereamic phases originated in the udder. Infected udders are clinically normal but they are important as a source of infection for calves and humans drinking the milk. Erythritol that produced by the fetus stimulates the growth of Brucella and stimulates localization of infection in the placenta and fetal fluids. Invasion of the gravid uterus results sever ulcerative endometritis. In acute infection of pregnant animal up to 85% of the bacteria are in cotyledons, placental membranes and allantoic fluid. In fetus, naturally and experimentally infected with B. abortus, the tissue changes include lymphoid hyperplasia in multiple lymph nodes, lymphoid depletion in thymic cortex, adrenal cortical hyperplasia and disseminated inflammatory foci composed mainly of large mononuclear leukocytes. In animal abortion occurs principally in the last three months of pregnancy, while in dogs occur around 50 days of gestation. Abortion in swine can occur at any time in gestation (Radostits *et al* ,2006).

1.6. Clinical Signs:

1.6.1. Clinical Signs in Animals**:**

Incubation period is 2 – 4 weeks. If there are no any pregnant animals (mostly heifers) brucellosis may have latent form however, if there are pregnant animals, typical clinical signs of brucellosis is mass abortion in the second half of pregnancy. It occurs after the 5 - 8 months pregnancy in cattle, Sheep and goat 3-5 months, Pigs may abort in both first and second halves and Dog 40 – 50 days .Retained placenta and metritis could be expected to be common at this time. In male Orchitis and epididymitis with acute inflammation can be characterized by painful swelling twice the normal size are cardinal signs (Mantur, and Mangalgi, 2007).

1.6.2. Symptoms of Human Brucellosis**:**

The most common symptoms of brucellosis include undulant fever in which the temperature can vary from 37.8°C in the morning to 40°C in the afternoon; night sweets with peculiar odder and weakness. Common symptoms also include insomnia anorexia, headache, constipation, sexual impotence, nervousness, encephalitis, spondylitis, arthritis, endocarditis, orchitis and depression. Spontaneous abortion mostly in the first and second trimesters of pregnancy, are seen in pregnant women infected with Brucella. Lack of appropriate therapy during the acute phases may result in localization of Brucella in various tissues and organs and lead to sub acute or chronic disease which is very hard to treat (.Quinn *et al*, 2002).

1.7. Public Health Significance:

The most pathogenic and invasive species for human are, B.melitensis, B. abortus and *B. canis*. Human Brucellosis caused by *B. melitensis* is the most severe one followed by B. *suis,* B. *abortus* and *B. canis* in their decreasing order. An outbreak of brucellosis would be difficult to detect because the initial symptoms are easily confused with those of influenza (Nuru and Schnurrenberg ,1995).

1.8. Impact of Brucellosis on Animal Production:

Animal population's brucellosis is might lead to a lower calving rate due to temporary infertility and/or abortion resulting in a decreased milk production cows, increased replacement costs as well as lowered sale value of infected cows. General economic losses, however, go far beyond the financial losses suffered by cattle producers alone. Not only cattle but also other species might be affected by brucellosis, including humans (Scholze *et al,* 2008).

1.9. Economic Losses of Brucellosis:

Losses due to abortion in the affected animal population, diminished milk production, brucella mastitis and contamination of milk, Cull and condemnation of infected animals due to breeding failure, endangering animal export trade of a nation Human brucellosis causing reduced work capacity through sickness of the affected people, government costs on research and eradication Schemes and losses of financial investments (Wadood *et al* 2009).

1.10. Diagnosis:

The diagnosis of brucellosis always requires laboratory confirmation. It is made possible by direct demonstration of the causal organism using staining immunofluorescent antibody, culture and directly demonstration of antibodies using serological techniques (Georgios *et al*, 2005).

1.10.1. Microscopic Examination and Culture Methods**:**

Specimen of fetal stomach, lung, liver, placenta**,** cotyledon and vaginal discharges are stained with Gram stain and modified Ziehl Nelson stains. Brucella appears as small red-colored, coccobacili in clumps. Blood or bone marrow samples can be taken cultured in 5-10% blood agar is used. To check up bacterial and fungal contamination; Brucella selective media are often used. The selective media are nutritive media, blood agar based with 5% sero negative equine or bovine serum. On primary isolation it usually requires the addition of 5-10% carbon dioxide and takes 3-5 days incubation at 37°C for visible colonies to appear (.OIE, 2000).

1.10.2. Animal Inoculation:

Lab animals such as guinea pigs are intramuscularly inoculated 0.5-1ml of suspected tissue homogenate and sacrificed at three and six weeks pos inoculation and serum is taken along with spleen and other abnormal tissue for serology and bacteriological examination (Georgios *et al*, 2005).

1.10.3. Serological Examination:

Body fluids such as serum uterine discharge, vaginal mucus and milk or semen plasma from suspected cattle may contain different quantities of antibodies of the IgM, IgG1, IgG2 and IgA types directed against Brucella (OIE, 2000).

Milk Ring Test (MRT):

The milk ring test is a satisfactory inexpensive test for the surveillance of dairy herds for brucellosis. Brucella milk ring test is a screening test for brucellosis infection at the herd level by taking a small sample of pooled fresh milk or cream, from no more than 25 cows. The test is based on the principle of agglutination test that can be carried out with body fluids other than serum that is with milk. In the milk ring test stained *Brucella abortus* organism with *methylene blue dye or Rose Bengal* dye *is* used as suspension of antigen(.Nielson *etal*, 2001) .The principle of the test is that if the organism is chronically affected by brucellosis the antibody which is secreted together with milk will react with *stained Brucella antigen* and *blue ring* will be formed at the top where the cream is located(OIE, 2009).

Rose Bengal Plate Test (RBPT):

It is a spot agglutination technique. It does need special laboratory facilities and is simple and easy to perform. It used to screen sera for Brucella antibodies. The test detects specific antibodies of the IgM and IgG type. Although the low PH (3.6) of the antigen enhances the specificity of the test and temperature of the antigen and the ambient temperature at which the reaction takes place may influence the sensitivity and specificity of the test (AUSVETPLAN, 2005).

*Complement Fixation Test (CFT***):**

The CFT test is highly specific but it requires highly trained personnel as well as suitable laboratory

facilities. It measures more antibodies of the IgG1 type than antibodies of the IgM type (Nielson etal, 2001).

The CFT is widely used and accepted as a confirmatory test although it is complex to perform, requiring good laboratory facilities and adequately trained staff to accurately titrate and maintain the reagents. There are numerous variations of the CFT in use, but this test is most conveniently carried out in a micro titer format. Either warm or cold fixation may be used for the incubation of serum, antigen and complement: either 37°C for 30 minutes or 4°C for 14–18 hours. A number of factors affect the choice of the method: anti- complementary activity in serum samples of poor quality is more evident with cold fixation, while fixation at 37°C increases the frequency and intensity of prozones and a number of dilutions must be tested for each sample (.Xavler *et al,* 2009).

Enzyme linked immunosorbet assay (ELISA) test:

It is a test which offers excellent sensitivity and specificity with a minimum of equipment and sources in kit form. Is more suitable than the complement fixation test for use in smaller laboratories and now it is used for the diagnosis of wide range of animal and human diseases (Mantud, 2007).

1.11. Molecular methods

1.11.1. Polymerase Chain Reaction (PCR):

New techniques allowing identification and sometimes quick typing of Brucella at the genus, species and biovar levels have recently improved the diagnostic capacities. A number of these molecular methods have been developed and its applications ranges from diagnosis of the disease, and characterization of field strain for epidemiological purposes (Gopaul, Koylass, Smith, & Whatmore, 2008).

Molecular typing of Brucella has also been used for epidemiological trace back in disease outbreaks and is an important component of disease eradication pro grammes. However, PCR assays lack validation and improvement of specificity and sensitivity in comparison to other tests. Nevertheless, PCR techniques show a lower diagnostic sensitivity than culture methods, although their specificity is close to 100% (Bricker, 2002). The best results have so far been obtained by combining culture and PCR detection on clinical samples.

1.12. Differential Diagnosis*:*

There are many potential causes of abortion in Animal. Endemic infectious causes of abortion include viral diseases such as infectious bovine rhinotracheitis and; and infections with other organisms such as Trichomonas foetus, Neospora caninum, Campylobacter foetus, Listeria monocytogenes, various Leptospira species , fungi and Rift Valley fever (.Poester *et al* 2013).

1.13. Postmortem Findings:

1.13.1. Gross Findings:

In cows, the main sites of infection are the endometrium of the uterus and the foetal placenta the uterus appears normal externally but the endometrium is invariably infected. The inter cotyledonary areas of the placenta are generally thickened with yellow gelatinized fluid and may be ulcerated, appear like leather and have mucoid or fibrino-purulent deposits on the surface. Placental cotyledons are hyperemic and may have areas of yellow–grey necrosis and be covered with a sticky brown exudates (Hong, 1991).

The uterus of infected cows is characterized by brownish Fluid, with exudates consistent with a necrotizing placentitis and the uterus can also show fibrinous necrotic exudates and multifocal haemorrhages (Luzzi *et al,* 1993).

The foetus is usually swollen, with blood-tinged fluid found subcutaneously and in the body cavities; the umbilical cord may be thickened and swollen. The most important lesion is a catarrhal or fibrinous pneumonia (Poester *et al,* 2013).

Other lesions include fibrinous pleuritis and peritonitis, bronchopneumonia and splenitis (Solera, 1995). Fibrinous pericarditis has been described as a significant fetal lesion in brucellosis (Hong, 1991).

In Bulls, B. abortus causes infection and swelling of the testicles that may not be obvious, but increasing pressure results in necrotic foci that grow and coalesce and may lead to total testicular necrosis with sequestration by inflammatory thickening of the tunica. B abortus may also infect the accessory sex glands Brucellae in cattle may localize in the carpal and other bursae, where hygromas containing large numbers of bacteria may be found. (Poester *et al*, 2013).

1.13.2. Microscopic Findings:

In Cows, when examined microscopically, the membranes and cotyledons contain many mononuclear cells with some neutrophils and the chorionic epithelial cells are packed with the bacteria. Abnormally firm attachment of the chorionic villi of the placenta results from necrosis and enlargement of the maternal villi and the presence of inflammatory exudates (Poester *et al,* 2013).

Necrotic neutrophilic placentitis with perivascular infiltrates is the most frequent microscopic change in experimentally infected cows and inflammation is associated with large numbers of B. abortus cells inside macrophages and trophoblasts (Hong, 1991).

1.13. 11.Treatment:

Uncomplicated acute brucellosis almost invariable responds well to appropriate antibiotic treatment (Solera *et al*, 1997 and, Solera, 2000). In

those patients with complications, additional treatment, including in some cases surgical intervention will be necessary. To prevent disease progression and the development of complications, treatment should start as early as possible also inpatients showing signs of spontaneous improvement. In all cases it is important that the patient finishes the full course of medication because the risk of incomplete recovery and relapse is otherwise increased considerably. The standard treatment of uncomplicated cases in adults and children 8 yr of age and older is 100 mg doxycycline twice a day for 6 wk plus 1 g streptomycin daily for 2 to 3 week. Instead of streptomycin rifampicin may be given combination with doxycycline (200 mg/day orally for 6 wk) at a dose of 600-900 mg for 6 wk(Solera *et al*,1998).

2. Prevention and control

2.1. In animals:

Prevention and control of brucellosis can be adopted realistically through understanding of local and regional variations in animal husbandry practices, social customs, infrastructures and epidemiological patterns of the disease. The common approaches used to control brucellosis include, quarantine of imported stock, hygienic disposal of aborted fetuses, fetal membrane and discharges with subsequent disinfection of contaminated area. Animals which are in advanced pregnancy should be kept in isolation until parturition (Mantur, 2007). Moreover replacement stock should be purchased from herd free of brucellosis, and decide for or against immunization of negative animals. Eradication by test and slaughter of positive reactors is also possible (Walker, 1999).

2.2. Vaccination:

Vaccination as the sole means of brucellosis control has been proven to be effective. Reduction in the number of positive animals in a herd is directly related to the percentage of vaccinated animals. However, when proceeding from a control to an eradication program, a test and slaughter program is necessary. Modified live vaccines are available against Brucella spps. B. abortus S19, RB51 and B. melitensis Rev.1 are proven effective vaccines against B. abortus in cattle and against B. melitensis and B. ovis in sheep and goats, respectively (Elberg, 1996). Despite the availability, these vaccines have several drawbacks, including residual virulence for animals and humans (Gamboa *et al,* 2009).

2.3. Chemotherapy:

It is mostly not successful because of intracellular sequestration of the organisms in the lymph nodes, mammary glands and reproductive organs. If it is necessary the treatments often given are, sulphadiazine, streptomycin, chlortetracycline and chloramphenicol and Radostits, 2006).

2. 4. In human:

The most rational approach for preventing human brucellosis is control and eradication of the infection in animal reservoirs. In addition there is a need to educate the farmers to take care in handling and disposing of aborted fetus, fetal membrane and discharges as well as not to drink unpasteurized milk and abattoir workers in transmission of infection especially via skin abrasion (Acha and Szyfers 2001). The drug recommended is rifampcin at dosage of 600 - 900 mg daily combined with doxicycline at 200 mg daily. Both drugs are given in the morning as asingle dose and relapse is unusual after a course of treatment continued for at least 5 weeks (WHO (1997).

3. Conclusion and recommendations:

Brucellosis is worldwide and has high prevalence in many African countries. Brucellosis affected both animals and humans, has a very high economic and public health impact. Its impact on Public health is very well related to the infected animal species from which human transmission occurs. The disease transmits from infected animals to human beings through several routs. It is special hazard to occupational groups. It causes considerable losses in cattle as a result of abortion and reduction in milk yield. Even though the disease is prevalent in Ethiopia, few reports in human are available. This may be due to absence of appropriate diagnostic facilities. Based on the above concluding, the following recommendations are forwarded, so these are:- To reduce the economic losses and public health impact of the disease, control and eradication of brucellosis in animals should be designed at the national level, to convince the decision makers, prevalence, distribution, economic and public health impact of the disease should be well studied and documented, reference laboratories have to be established at national level, Public education on the transmission and source of infection of the disease need to be undertaken and the necessary precautions should be taken to reduce occupational risks.

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4. References

[1]. Abubakar M, Arshed MJ, Hussain M, Ehtisham-ul-Haq AQ. (2010): Serological evidence of Brucella abortus prevalence in Punjab province, Pakistan—a cross-sectional study. Transbound Emerg Dis **57**:443

[2]. Acha PU, Szyfers B. (2001): Zoonosis and Communicable Diseases Common to man and *Animals. 3rd ed. Pan America Health Organization* in Washington, D.C., Pp. 40-296.

[3]. Arenas GN, Staskevich AS, Aballay A, Mayorga LS (2000): Intracellular trafficking of Brucella abortu in J774 macrophages. Infect Immun **68**:4255–63.

[4]. Armon L, Hadani Y, Chechik C, Bardenstein S. Large Human Brucella melitensis outbreak in Israel. Isr J *Vet Med2015*; **70**:63–5.

[5]. Aulakh HK, Patil PK, Sharma S, H Kumar, Mahajan V and KS Sandhu, 2008. A Study on the Epidemiology of bovine brucellosis in Punjab (India) using milk-ELISA. *Acta Vet Brno,* **77:** 393–399.

[6]. Australian Veterinary Emergency Plan (AUSVETPLAN), 2005. Bovine Brucellosis Prevalence in and around Australia. 3rd ed. Journal of Applied Microbiology, 11: 8-9.

[7]. Baba MM, SE Sarkindared and F Brisibe, 2001 and Grillo MJ, MJ DeMiguel, PM Munoz, CM Marin, J Ariza and JM Blasco, 2006.d. Serological evidence of brucellosis among predisposed patients with pyrexia of unknown origin in the north eastern Nigeria. Cent Eur J Pub Health, **9:** 158– 161.

[8]. Bataineh H. Clinical study of childhood brucellosis in Jordan.Mid East J Fam Med2007; **5**:135–8.

[9]. Bricker, B. J. (2002). PCR as a diagnostic tool for brucellosis. Veterinary microbiology, **90(1),** 435-446.

[10]. Brucella microti sp. Nov., isolated from the common vole Microtis arvalis. Int. J. Syst. Evol Microbial., 58: 375-382.

[11]. Colibaliy, N.D. and Yamego, K.R. (2000): Prevalence and control of zoonotic disease: Collaboration between public health workers and veterinarians in Burkina faso. *ACTA Trop*., **76**:53-57.

[12]. Corbel MJ. Brucellosis in humans and animals. Geneva (Switzerland): World Health Organisation; 2006.

[13]. Ducrotoy MJ, Bertu WJ, Ocholi RA, Gusi AM, Bryssinckx W, et al. Brucellosis as an emerging threat in developing economies: lessons from Nigeria. PLoS Negl Trop Dis 2014;8:e3008.

[14]. Economidou J, Kalafatas P, Vatopoulou D, et al. Brucellosis in two thalassaemic patients infected by blood transfusions from the same donor. Acta Haematol 1976; **55**:244–9.

[15]. England T, L Kelly, R D Jones, A MacMillan and M Wooldridge, 2004. A simulation model of brucellosis spread in British cattle under several testing regimes. Prev Vet Med, **63:** 63-73.

[16]. Erten M, Kurekci AE, Aysev D, Unal E, Ikinciogullari A. Brucellosis transmitted by bone marrow transplantation. Bone Marrow Transplant 2000; **26**:225–6.

[17]. Georgios, P., A. Nikolas, B.Mile and T. Epaminondas, 2005. Brucellosis in England J. Med., **352**: 25-36.

[18]. Gopaul, K. K., Koylass, M. S., Smith, C. J., & Whatmore, A. M. (2008). Rapid identification of Brucella isolates to the species level by real time PCR based single nucleotide polymorphism (SNP) analysis. BMC microbiology, **8(1**), 86.

[19]. Gul ST and A Khan, 2007. Epidemiology and epizootology of brucellosis:A review. Pak Vet J, **27**: 145-151.

[20]. Hirsh DC, Zee YC (1999). *Veterinary Microbiology*. *Black Well Science*. Pp 196-226.

[21]. Hoffmann D, 1999. Asian Livestock to the Year 2000 and beyond.Working Paper series 1/2, 1-44.

[22]. Hong, C.B., J.M. Donahue, R.C. Giles, K.B. Poonacha, P.A. Tuttle and N.E. Cheville, 1991. Brucella abortusassociatedmeningitis in aborted bovine fetuses. Veterinary Pathology, **28:** 492-496.

[23]. Kadiohire M, Mc Dermott JJ, Shoukri MM, Kyule MN (1997). Variation in the Prevalence of antibody to Brucella infection in cattle by farm area and district in Kenya. *Epidemiol. Infect*. **118**: 35-41.

[24]. Luzzi, G.A R. Brindle, P.N. Sockett, J. Solera, P. Klenerman and D.A. Warrel, 1993. Brucellosis. Imported and laboratory acquired cases, an over view of treatment trials. Trans. R.soc. Trop. Med. Hyg., **87:** 138-141.

[25]. Maadi H, M Moharamnejad and M Haghi, 2011. Prevalence of brucellosis in cattle in Urmia, Iran. Pak Vet J, **31**: 81-82.

[26]. Mantur BG, Mangalgi SS (2 007). Evaluation of conventional castanedaand lysis centrifugation blood culture techniques for

diagnosis of human brucellosis. J. Clin. Microbiol. **42**: 4327–4328.

[27]. Mantur BG, Mangalgi SS, Mulimani B. Brucella melitensis—a sexually transmissible agent. Lancet 1996; **347**:1763.

[28]. Mantur, B.G. and S.S. Mangalgi, 2007. Evaluation of conventional Castaneda and lysis centrifugation blood culture techniques for diagnosis of human brucellosis. J. clin. Microbial**. 42:** 4327-4328.

[29]. Matope G, Bhebhe E, Muma JB, Lund A, Skjerve E. Herdlevel factors for Brucella seropositivity in cattle reared in smallholder dairy farms of Zimbabwe. Prev Vet Med 2010; **94**:213–21.

[30]. Memish Z, 2001. Brucellosis Control in Saudi Arabia: Prospects and Challenges. J Chemother, **13**: 11–17

[31]. Muma JB, Samui KL, Siamudaala VM, Oloya J, Matope G, Omer MK, et al. Prevalence of antibodies to Brucella spp. And individual risk factors of infection in traditional cattle, goats and sheep reared in livestock-wildlife interface areas of Zambia. Trop Anim Health Prod 2006; 38:195–206.

[32]. Neilson D. Animal brucellosis. 2000, Blvd corporate, N.W.Boca Raton, FL: CRS Press, Inc; 1990, p. 33431.

[33]. Nielson, O., R. Steward, K. Nielson, L. Measurs and P. Duigan, 2001. Serologic survey of Brucella Species, antibodies in some animals of North America. J. Wild life Dis., 37: 89-100.

[34]. Nikokar I, Hosseinpour M, Asmar M, Pirmohbatei S, Hakeimei F, Razavei MT. Seroprevalence of Brucellosisamong high risk individuals in Guilan, Iran. J Res Med Sci 2011; 16:1 366–71.

[35]. Nuru, S. and P. Schnurrenberg, 1995. The present status of Bovine Brucellosis in Nigeria: It's prevalence, significance and areas of research need Bull. Office international Des Epizootics international Epizootics, 83(11-12): 1113-1123.

[36]. OIE, 2000. Ovine Epididimytis (B. ovis) Manual of standard for Diagnostic Test and Vaccines. 3rd ed. OIE, Paris, France, pp. 467-474.

[37]. OIE. 2009. Bovine Brucellosis; version adopted by the world Assembly of delegates of the OIE, pp: 639-640.

[38]. Olsen S, Tatum F. Bovine brucellosis. Vet Clin North Am Food Anim Pract 2010;26:15–386.

[39]. Pappas G, Bosilkovski M, Akritidis N, Mastora M, Krteva L, Tsianos E. Brucellosis and the respiratory system. Clin Infect Dis 2003; **37:**95–9.

[40]. Pappas G, P Papadimitriou, N Akritidis, L Christou and E VTsianos, 2006. The new global map of human brucellosis. Lancet Infect Dis**, 6:** 91–99.

[41]. Poester, F.P., L.E. Samartino and R.L. Santos, 2013. Pathogenesis and Pathobiology of brucellosis in livestock: Rev.sci.tech.off.int.Epiz, **32(1**): 105-115.

[42]. Quinn PJ, Carter ME, Markey B, Carter GR (1994). Brucella species in: Clinical Veterinary Microbiology Wolfe Publishing, England, Pp. 261-267.

[43]. Quinn PJ, Markey BK, Carter ME, Donnely WJC, Lonard FC, Maquire D (2002). Brucella species in Veterinary Microbiology and Microbial Disease, Londen, Black Well science Ltd., Pp. 999-1000.

[44]. Quinn, P.J., M.E. Carter, W.J.C. Donnely, F.C. Lonard and D. Maquire, 2002. Brucella Species in Veterinary Microbiology and Microbial Disease, Londen, Black Well Science ltd, pp: 999-1000.

[45]. Radostits ED, Gay CC, Inchcliff KW (2006). Veterinary Medicine Textbook of the disease of cattle, sheep, pigs, goats, and horses, 9th ed., Newyork: W. B. Sounders Company ltd., Pp. 867-882.

[46]. Radostits ED, Gay CC, Inchcliff KW (2006). Veterinary Medicine Textbook of the disease of cattle, sheep, pigs, goats, and horses, 9th ed., Newyork: W. B. Sounders Company ltd., Pp. 867-882.

[47]. Schelling E, C Diguimbaye, S Daoud, J Nicolet, P Boerlin, M Tanner and J Zinsstag, 2003. Brucellosis and Q-fever sero-prevalence of nomadic pastoralists and their livestock in Chad. *Prev Vet Me*d, **61:** 279 – 293.

[48]. Scholz, H.C., Z. Hubalek, L. Sedlacek, G. Vergnaud, H. Tomaso, S. Al Dahouk, F. Melzer, P. kampfer, H. Neubaver, A. Cloeckaert, M. Maquart, M.S. Zygmunt, A.M. Whatmore, E. Falsen, P. Bahn, C. Gollner, M. Pfeffer, B. Huber, H.J. Busse and K. Nockler, 2008.

[49]. Seifert HSH (1996). Brucellosis In: Tropical Animal Health.2nd ed. Klywer Acadamic Publishers, London, Pp.356-368.

[50]. Shang D, Donglou X, Jiming Y. Epidemiology and control ofbrucellosis in China. Vet Microbiol 2002**; 90:**165–82.

[51]. Solera, J., 1995. Doxycycline- rifampin versus doxycylcine-streptomycin in treatment of human a. State farm, Ethiopia. Fachburg Veterinaemedizin, Frei Universitate, Berlin, Msc Thesis

[52]. Solera J, Martinez-Alfaro E, Espinosa A. (1997): Recognition andoptimum treatment of brucellosis. *Drugs*; ***53****:*245-56.

[53]. Solera J. (2000): Treatment of human brucellosis. *J Med Liban*; ***48****:* 255-63.

[54]. Solera J, Martinez-Alfaro E, Espinosa A, Castillejos ML,Geijo P.(1998): Rodriguez-Zapata M.Multivariate model forpredicting relapse in human brucellosis. *J Infect* **36**:85-92.

[55]. Wadood F, M Ahmad, A Khan, ST Gul and N Rehman, 2009. Seroprevalence of brucellosis in horses in and around Faisalabad. Pak Vet J, **29:** 196-198.

[56]. Walker LR (1999). Brucella. In Veterinary Microbiology. Dwight, C., Hirsh, D.c. and Zee, Y.C. (ed). BlackGG science. Pp. 196-202.

[57]. Walker LR (1999). Brucella. In Veterinary Microbiology. Dwight, C., Hirsh, D.c. and Zee, Y.C. (ed). BlackGG science. Pp. 196-202.

[58]. WHO (1997): Emerging and Communicable Disease surveillance and control. The development of new brucellosis. Report of the WHO meetings, Genava, December, 1997: Pp.41-47.

[59]. Xavler, M.N., T.A. Palxao, E.P. Poester, A.P. Lage and R.L. Santos, 2009. Pathology, immunohistochemistry and bacteriology of tissues and milk of cows and fetuses experimentally infectedwith Brucella abortus. J. Comp. Pathol., **140:** 147-157.

[60]. Yagupsky P and EJ Baron, 2005. Laboratory exposures to Brucellae andimplications for bioterrorism. J Emerg Infect Dis, **11:** 1180–1185.

[61]. Young EJ, 1998. Human brucellosis. Rev Infect Dis, **5:** 821-842.

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