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RESEARCH ARTICLE

Human Brucellosis Incidence Trends in Central Saudi Arabia (DawadmiGovernate)

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Abstract

OBJECTIVE: To determine the human brucellosis incidence rate and trends and its pre-disposing patients' characteristics (age, gender) over a period of five years (2010- 2014) in Central Saudi Arabia (DawadmiGovernate)

METHODS: This is a retrospective study involved the review of 2600 medical records of suspected human brucellosis patients in a Dawadmi General hospital. The inclusion criteria were set based on Wright's test results and physicians' diagnosis. Descriptive statistics were utilized to assess incidence trends.

RESULTS: A total of 700 positive cases of human brucellosis, comprised of 450 males (64.28%) and 250 females (35.71%) were analyzed based on the SAT titer of $\geq$1:160 (Wright test) and clinical impression of the attending physicians, with a male to female ratio of 1.8:1. Almost 50% of the cases were between the ages 13 and 40. Fever, joint pain, headache and weakness were commonly manifested by the patients. The most frequent signs were splenomegaly and hepatomegaly.

CONCLUSION: The decreasing incidence trend of human brucellosis in Central Saudi Arabia over the last five years is a good indication that the health authorities and the people at risk in the community have improved their awareness about the disease. Sustained collaborative interventions among the concerned government agencies, health workers, local leaders and farm owners are necessarily recommended to completely eradicate or at least reduce human brucellosis cases in the Kingdom of Saudi Arabia.

INTRODUCTION

The World Health Organization (WHO) affirms that brucellosis persists to be one of the significant and prevailing global zoonotic infections.[1] Brucellosis is endemic in nations of the Middle East, Mediterranean, Central America, South America, Mexico and South Asia.[2]Basically, it affects domestic animals such as dogs, camels, cows, goats and sheep. Human-to-human transmission is rarely encountered.[3] Infection to man is traced to consumption of raw milk, meat or cheese as well as direct contact with diseased animals and inhalation of aerosolized particles.[4]Annually, an estimated 500,000 new human brucellosis cases have been reported worldwide with a prevalence rate of 10/100,000.[5,6]Among the Arabian Gulf countries, Syria (1,603 cases/million per year), Turkey

(15,000 cases in 2004) and Kuwait (500 cases/million for the last 20 years) registered the highest incidence of the disease.[5]Based on a nationwide survey, the prevalence rate of the disease among humans in the Kingdom of Saudi Arabia (KSA) has been recorded as forty (40) in every 100,000 population.[7]Nonetheless, a reduction of the disease proportion to 16.89 per 100,000 has been reported in 2006.[8]

Brucellosis is an infection that affects body's organ system but failure to correct diagnose cases results to an inaccurate incidence rate.[9] Nonspecific symptoms comprise fever, myalgia, headache, arthralgia, malaise and fatigue.[10] Epididymo-orchitis, spondylitis and peripheral arthritis are considered as the most frequent localized syndromes.[11]The etiologic agent of human brucellosis is an organism that belongs to the genera *Brucella*, a minute, fastidious gram-negative coccobacilli. *B. melitensis*, *B. abortus*, *B. suis* and *B. canis* are the four pathogenic species affecting humans. *B. melitensis* (most virulent and invasive) is isolated from camels, goats and sheep; *B. abortus*(least virulent and invasive) from cows; *B. suis* from pigs; and *B. canis* from dogs. Eighty percent of human cases in KSA are attributed to *B. melitensis*.[12,13,14,15]

Periodical review of the disease has been initiated in reference to previous and emerging medical literature.[16-21] A recent study in Al-Ahsaa, Saudi Arabia found out that there was a remarkable decline in the number of human brucellosis cases for the period from 2000-2004.[8]Reported cases of the disease were notable in the various parts of Saudi Arabia such as in the Eastern[22], Northern[23], Central[24] and Southern regions [25,26]. Susceptible workers have been implicated with the disease, posing a serious risk among clinical laboratory personnel in hospitals of Saudi Arabia.[14,27]A survey among 1290 workers in a Saudi abattoir found out the human brucellosis was detected on butchers (8.9%), veterinary doctors and their assistants (5.4%).[28] Another study in the Southwestern region of Saudi Arabia (Asir) engaged with 1336 patients who a vailed of laboratory blood tests for human brucellosis. More than half (58.7%) of the patients complaining with fever exhibited a significant titer.[15]

Previous epidemiological studies done in Saudi Arabia revealed that human brucellosis affect both males and females at any age. However, the age group 15-50 years old was the most vulnerable with more males being infected than females (2:1).[3] The incidence of the disease elevates in spring through summer secondary to the shipment of goats and sheep for the annual religious rites in the country.[26,29,30] Diagnosis of human brucellosis can be confirmed by blood culture though detection of antibodies is essential. Exposure history is likewise helpful in the early diagnosis of the disease.[14]

This retrospective study aimed to determine the incidence of human brucellosis and its pre-disposing patients' characteristics (age, gender) in a hospital at the Central region of Saudi Arabia (DawadmiGovernate).

MATERIALS AND METHODS

This retrospective study reviewed two thousand six hundred (2600) medical records of suspected human brucellosis patients, who consulted a government hospital in the Central Saudi Arabia over a period of five years (January2010-December 2014). The data obtained included laboratory results for Wright test of patients with their age and gender. The inclusion criteria used selected the patients who were definitively diagnosed with the disease and those who exhibited a significant titer ($\geq$1:160) with a Serum Agglutination Test (SAT) by Wright et al. Physicians diagnosed patients for human brucellosis as reflected in their medical records based on hallmark symptoms of the disease and confirmed by laboratory tests, namely SAT and/or blood culture.

Wright's serum agglutination test procedure.

Wright's sero-agglutination is a technique of slow agglutination in tubes developed by Wright et al. in 1897 .[31], is still the reference to which other tests are compared. The following were the sample, control materials and reagents used in the test:

1. Sera to be tested;
2. Positive and negative sera;
3. Concentrated antigen (10 x);
4. Distilled water; and
5. Phenoled salt water.

The highest dilution of the patient's serum exhibiting agglutination was recorded. Simultaneously, positive and negative controls were run and results saved for reference purposes. Test kit instructions of the supplier were followed and the significant titer of the patient's sample was calculated.

Criteria for clinical diagnosis.

The physicians observed suspected patients who complained of fever, accompanied by anorexia, arthralgia, chills, fatigue, headache, myalgia, sweats, weakness and weight loss. Using the SAT by Wright et al., a significant titer of ≥1:160 is diagnostic of human brucellosis. Previous studies on brucellosis adopted this set of criteria, which the Centers of Disease Control and Prevention (CDC) likewise recommends.[32]

The Research Ethical Committee of the hospital provided the permission to conduct the study. Descriptive statistics were utilized to assess the incidence trends.

RESULTS

Two thousand six hundred (2600) medical records of patients suspected of human brucellosis in Central region of Saudi Arabia (DawadmiGovernate)for a period of five year were analyzed. Of the 2600 patients, 1350 (51.92%) were males and 1250 (48.07%) were females as indicated in Table 1. The serum agglutination test (Wright et al.) results identified 700 (26.92%) of the reviewed patients' medical records as positive cases of the disease as reflected in Table 2. The highest number of positive cases was reported in 2010, 210 cases (30%), followed by 170 cases (24.28%) in 2011; 150 (21.42%) in 2012; 80 (11.42%) in 2013; and a slight increase in 2014, 90 cases (12.85%) table 3.

Out of the 700 positive cases, males were 450 (64.28%) and they outnumbered the females at 250 (35.71%) resulting to a Male**:**Female ratio of 1.8**:**1. In terms of age, the most vulnerable groups were 13-30 years old (42.85%) and 31-40 (28.57%) for both males and females, constituting almost two-thirds (71.42%) of the positive cases. Table 4 indicates the SAT titer among the reactive cases. Almost two-thirds of the positive results (71.42%) exhibited a *Brucella* titer of 1:160. The highest titer recorded was 1:1280 (21.42%). Along the symptoms and signs associated with human brucellosis, more than two-thirds of the cases manifested fever (85.71%) and arthralgia or joint pain (78.57%) as shown in Table 5. Less than half of the patients experienced bone pain (42.85%), headache (41.17%) and weakness (41.17%) were complained by one-thirds of the affected individuals. Splenomegaly (21.42%) and hepatomegaly (14.28%) emerged to be the most distinct signs as indicated by the medical charts of the positively affected patients.

Table 1.Distribution of subjects by age and sex.

Age (yrs)	Males		Females		Total	
	n	(%)	n	(%)	N	(%)
≤ 12	300	11.53	300	11.53	600	23.07
13 – 30	250	9.61	200	7.69	450	17.3
31 – 40	350	13.46	250	9.61	600	23.07
41 – 50	200	7.69	200	7.69	400	15.38
51 – 60	150	5.76	250	9.61	400	15.38
> 60	100	3.84	50	1.92	150	5.76
Total	1350	51.92	1250	48.07	2600	100

Table 2.Distribution of subjects by positive result with SAT (Wright et al.).

Age (yrs)	Serum Agglutination Test by Wright et al.				Total	
	Males		Females		N	(%)
	n	(%)	n	(%)		
≤ 12	0	0	0	0	0	0
13 – 30	200	28.57	100	14.28	300	42.85
31 – 40	150	21.42	50	7.14	200	28.57
41 – 50	50	7.14	50	7.14	100	14.28
51 – 60	50	7.14	50	7.14	100	14.28
> 60	0	0	0	0	0	0
Total	450	64.28	250	35.71	700	100

Table 3. Distribution of human brucellosis cases by years.

year	n	%
2010	210	30
2011	170	24.28
2012	150	21.42
2013	80	11.42
2014	90	12.85
Total	700	100

Table 4. Distribution of human brucellosis cases by SAT titer.

Brucella titer	n	%
1:160	500	71.42
1:320	0	0
1:640	50	7.14
1:1280	150	21.42
Total	700	100

Table 5.Human brucellosis symptoms and signs among the 700 positive patients.

Symptom	**n**	**%**
Fever	600	85.71
Arthralgia/Joint pain	550	78.57
Ostealgia/Bone pain	300	42.85
Headache	250	35.71
Lethargy/Weakness	250	35.71
Anorexia	200	28.57
Body ache	100	14.28
Sweating	100	14.28
Abdominal pain	80	11.43
Vomiting	60	8.57
Weight loss	50	7.14
Chills	50	7.14
Diarrhea	30	4.29
Sign	**N**	**%**
Splenomegaly	150	21.42
Hepatomegaly	100	14.28
Lymphadenopathy	50	7.14

DISCUSSION

The etiologic agent of brucellosis is a Gram-negative coccobacillus, which belongs to the genus *Brucella*. Six species have been significantly associated with infections on various hosts, namely *Brucellaabortus*, *B. canis*, *B. melitensis*, *B. suis*, *B. ovis* and *B. neotomae* that affect dogs, goats/sheeps, pigs, rams and desert rats, respectively. At present, *B. melitensis*prevails the major causative agent of global human brucellosis. Recently, a new strain isolated from marine mammals has been implicated with pathogenic conditions. These facultative intracellular bacteria usually cause soft tissue and organ infections.[33-41]Multisytem involvement is common in human brucellosis cases, with complications frequently affecting the skeleton, GIT and blood. CNS and heart involvements are considered as the most severe.[12,41-47]

This current study contributes to further investigations being conducted on human brucellosis, particularly in the Central region of Saudi Arabia (DawadmiGovernate). Almost two-thirds of the affected patients belonged to the age groups of 13-30 and 31-40 years old. This finding is consistent with various studies in Eastern and Northern parts of Saudi Arabia; in Al-Ahsa; in Jeddah; and in Tabuk.[3,8,22,23,48]Previous studies noted seasonal variation.[48-50]The male to female ratio (1.8:1) of human brucellosis infection in this research is a duplicate of the ratio in Tabuk while 1.7:1 ratio in Northern KSA.[23,48]The highest incidence of the disease was recorded in 2010 particularly in spring towards summer, when citizens, residents/expatriates travel to farms and villages for leisure. Part of these

visits, local people and visitors consume milk and milk products freshly collected from goats or camels.[49,50,51]The noticeable declining trend in the number of diagnosed cases from 2010 could be attributed to several factors such as the efforts of the Ministry of Agriculture to vaccinate animals at risk of contracting brucellosis infection and the intensified health drive of the government to educate the public about the nature of the disease and enhance awareness among the most prone individuals. Similar decreasing patterns were reported by recent studies.[8,23]

In terms of clinical manifestations, fever and arthralgia were the most common symptoms recorded from the patients. Other previous researches confirm these results.[13,23,47-51]Seventeen cases in this paper have demonstrated symptoms affecting the GIT (abdominal pain, vomiting and diarrhea). The studies conducted in Asir and Northern KSA indicated similar GI symptoms.[23,52]Systematic reviews are available detailing the diagnostic symptoms of human brucellosis in Saudi Arabia and other endemic areas.[1,2,4]Splenomegaly and hepatomegaly were also observed among the patients, as likewise depicted in Northern Saudi Arabia and Tabuk City.[23,53]

Up to this date, brucellosis is still a health concern in Saudi Arabia despite the decreasing number of cases over the past few years. Identified factors that tend to complicate the efforts of the governmental health authorities to reduce the incidence of the disease include the non-stop arrival of pilgrims for the hajj season and the trade of goats and sheep from other countries to be slaughtered inside the Kingdom. However, preventive and control measures are suggested to manage the risk of human brucellosis infection. Controlling human brucellosis is dependent on eradicating brucellosis in animals. The recommendations that can contribute to eliminating animal brucellosis include improving the reporting system of cases to the concerned health agencies; implementing health education among the vulnerable people; vaccinating livestock; compliance to strict hygienic standards in farms; enforcing existing laws and regulations regarding importation of animals; establishing strategic centers to quarantine affected animals; presence of guidelines on screening and isolating affected animals.[3]

CONCLUSION

The decreasing incidence trend of human brucellosis in Central Saudi Arabia (DawadmiGovernate) over the last five years is a good indication that the health authorities and the people at risk in the community have improved their awareness about the disease. Sustained collaborative interventions among the concerned government agencies, health workers, local leaders and farm owners are necessarily recommended to completely eradicate or at least reduce human brucellosis cases in the Kingdom of Saudi Arabia.

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