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Original Research

Human brucellosis in northern borders, Saudi Arabia: Epidemiologic features and common presentation

Human brucellosis in Northern Saudi Arabia

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Abstract

Aim: Brucellosis is one of the major bacterial zoonoses that threatens the public health system in many countries in North Africa and the Middle East, including Saudi Arabia. This study aimed to identify the pattern of Brucellosis infection from 2020 to 2023 and to determine the demographic structure and clinical features of Brucellosis infection in the Northern Border region of Saudi Arabia.

Material and Methods: A retrospective review of hospital records for Brucellosis from 2020 to 2023 was obtained from the North Medical Tower and the Prince Abdul-Aziz bin Musaed Hospital in the Northern Border Region, Saudi Arabia. Patients' demographic characteristics, including age, gender, nationality, presentation symptoms, and results of the Slide Agglutination Test for Brucellosis were obtained.

Results: A total of 647 samples were examined between 2020 and 2023. The number of Brucellosis cases was 98, which progressively decreased from 51 cases in 2020 to only one case in 2023. Male patients predominated (82.65%) with high frequency in the age groups of 30 to 40 years (34.69%) and 20 to 30 years (28.57%). The most common symptoms observed in the current study were swinging fever (53.1%), back pain (37.7%), rigor (33.7%), and joint pain (19.4%), while 28.6% were asymptomatic cases.

Discussion: The incidence of Brucellosis infection was progressively decreased with a predominance of male patients aged 20 to 40 years. This confirms the national public health interventions and highlights the importance of awareness campaigns and surveillance systems among high-risk individuals and livestock to prevent transmission and facilitate case detection, particularly in asymptomatic patients.

Keywords

Brucellosis, Demographics, Clinical Presentations, Slide Agglutination Test (SAT), Northern Border Region

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This study was approved by the Ethics Committee of the Northern Border University (Date: 2023-07-05, No: 50/44/H) and the Institutional Review Board of the Ministry of Health, Arar, Saudi Arabia (Date: 2023-11-29, No: N1C-IRB-023-10-044)

Introduction

Brucellosis is one of the major bacterial zoonoses, and in humans, it is also known as Undulant fever, Malta fever, or Mediterranean fever [1]. It is a significant threat to the public health system in many countries in North Africa and the Middle East, including Saudi Arabia [2]. Globally, the annual incidence of brucellosis has been estimated as 2.1 million, with higher levels in Africa and Asia [3]. Saudi Arabia had the highest occurrence of human brucellosis among Eastern countries [4]. Based on data from the Ministry of Health (MOH), the reported cases of brucellosis demonstrate a fluctuating pattern over the period from 2019 to 2022. The number of reported brucellosis cases in Saudi Arabia showed the following pattern: In 2019, there were 4,257 reported cases, which decreased to 2,372 cases by the end of 2020 [5]. But by the end of 2021, the number of cases elevated to 2,400 [6]. However, in 2022, there was a noticeable increase, with reported cases rising to 2,543 [7]. The distribution of the disease is over the country, and the most prevalent part is Al-Qassim and Aseer in the south, followed by Hail and the North of Saudi Arabia [8]. According to the statistics provided by the Saudi Ministry of Health, the number of reported cases in the Northern Borders region showed an increase from 33 cases in 2021 to 40 cases in 2022 [6, 7]. Males suffer more frequently than females because of greater occupational exposure. According to the Saudi Ministry of Health, in 2022, the number of affected Saudi males was 1,176, and non-Saudi males were 761. The biggest numbers of cases were reportedly found between age 15-45 (n = 1,451 cases), while 793 cases were ≥ 45 years old. [7] Particularly, there are special risks for Farmers, Shepherds, Butchers, Abattoir workers, Veterinarians, and Laboratory workers [1].

Brucellosis is caused by Brucella species. It is classified as a biological agent because of how contagious it is and how it affects human health. Brucellae are Gram-negative, non-spore-forming, non-motile coccobacilli and facultative intracellular parasites that cause a chronic disease that usually persists for life. Four common species can infect humans, including B. abortus, B. melitensis, B. canis, and B. suis, and less commonly, B. inopinata. B.melitensis is the most virulent and invasive species [1]. Human brucellosis is spread either by direct or indirect contact with diseased animals or by eating tainted food. Due to inadequate hygiene and unprotected animal interaction, it is seen as a serious issue in endemic nations [8]. Brucellosis is most prevalent under conditions of advanced domestication of animals in the absence of correspondingly advanced standards of hygiene, overcrowding of herds, high rainfall [1]. However, in Saudi Arabia, the highest number of cases were reported in August, with 311 cases, followed by June, with 309 cases [7].

The epidemiology of brucellosis in Saudi Arabia is difficult to manage, and it differs from the situation in other nations. Since there are numerous distinct characters and determining elements, Saudi Arabia greets millions of pilgrims who come for Umrah and Hajj, including the importation of a substantial number of sheep to meet the demands of the Hajj season is one of the key factors causing the disease's spread in the Kingdom. Furthermore, Saudi Arabia has a long transitional history of housing camels that has resulted in direct contact with diseased animals and the consequence that they drink raw, unpasteurized camel milk and consume camel meat. Although the management is difficult currently, there is improvement in the domestic livestock protective precautions beginning with a mass vaccination program for animals and strict legislation, and for that, nowadays, there has been an obvious decline in the incidence and occurrence of brucellosis [4].

Brucellosis causes a variety of clinical symptoms that can last from a few days to several years [9]. Disease in humans ranges from asymptomatic to acute disease. Clinical features typically characterized by non-specific flu-like illness manifesting as swinging pyrexia, rigors and sweating, arthralgia/arthritis, and headache in addition to the subsequent complications, e.g., splenomegaly, hepatomegaly, leucopenia with relative lymphocytosis [1, 10].

Brucellosis is difficult to diagnose due to the lack of distinctive symptoms, weak diagnostic procedures, inadequate diagnostic methodologies, and a lack of suitable reagents for diagnosis [8]. Brucellosis is routinely diagnosed by serology, Slide Agglutination Test (SAT), which is considered the first line test, yet it may cross-react with IgM of different organisms such as Salmonella enterica serotype Urbana, Francisella tularensis, and other [11].

Brucellosis has been endemic in Saudi Arabia since the early 1980s. Its spread has been studied in different regions, where certain areas and the presence of animals (sheep) have been identified as risks for brucellosis. Our study is the first to highlight the Northern Border Region, epidemiologic features, and a wide range of clinical manifestations and laboratory findings among patients to define the pattern from 2020 to 2023.

Description of the study

The present study aimed to retrospectively identify the most common clinical presentations of human brucellosis in Northern Borders, Saudi Arabia, between 2020 and 2023.

Objectives

• To identify the pattern of Brucellosis infection in the Northern Border Region from 2020 to 2023.

• To describe the most common clinical presentations of Brucellosis in the Northern Borders.

• To identify the demographic structure of Brucellosis cases in the Northern Border Region, Saudi Arabia.

Material and Methods

Study design and settings

A retrospective review of all hospital records (2020-2023) for Brucellosis patients obtained from two public tertiary hospitals in Arar City, the capital of the Northern Borders Region, with a population of about 200,000 in 2022. These are the North Medical Tower and the Prince Abdul-Aziz bin Musaed Hospital. The two hospitals serve people in Arar and other cities in the Northern Borders, namely Rafha, Turayf, and Al Uwayqilah. Both hospitals have highly qualified medical staff, good equipment and facilities, provide outpatient, inpatient, and emergency services, and receive referrals from other hospitals and health centers in the Northern Border region.

Data collection procedure

Medical records of patients with Brucellosis were reviewed for patients' demographic characteristics in terms of age, gender, nationality, and symptoms at presentation. Results of Slide Agglutination Tests (SAT) were obtained. In Saudi Arabia, a titer of ≥1:320 was considered positive for Brucellosis, and a titer of 1:160 was considered positive if associated with clinical evidence of Brucellosis.

Data management

The collected data will be entered, described, and presented using the computerized statistical package STATA/SE version 11.2 for Windows (STATA Corporation, College Station, Texas) and MS Excel.

Ethical approval

This study was approved by the Ethics Committee of the Northern Border University (Date: 2023-07-05, No: 50/44/H) and the Institutional Review Board of the Ministry of Health, Arar, Saudi Arabia (Date: 2023-11-29, No: N1C-IRB-023-10-044).

Results

Over the period between 2020 and 2023, 647 subjects had Slide Agglutination Test (SAT) for Brucellosis at the North Medical Tower and the Prince Abdul-Aziz bin Musaed Hospital in Arar. Table 1 shows the results of SAT for Brucella abortus and Brucella melitensis. Antibodies for Br. melitensis were detected in all subjects, while Br. abortus antibodies were undetectable for 167 (25.81%) subjects.

In Saudi Arabia, a titer of 1:320 or higher is considered positive. A titer of 1:160 is borderline and is considered positive if there is clinical evidence of brucellosis. Table 2 shows the incidence of Brucellosis between 2020 and 2023 in Arar. The number of cases progressively decreased from 51 cases in 2020 to only one case in 2023.

Table 3 shows the frequency distribution of incident Brucellosis cases by gender, age, and nationality. Males accounted for 82.65% of Brucellosis cases. The highest frequency was recorded in the age group 30-40 years (34.69%), followed by the age group 20-30 (28.57%). The frequency of cases was higher among Saudi people (47.06%) in 2020 compared to other nationalities. However, Sudanese had the higher frequency from 2021 to 2023.

Figure 1 shows that swinging fever was the most frequent symptom of Brucellosis (53.1%), followed by back pain (37.7%), rigor (33.7%), joint pain (19.4%), and headache (17.3%) while 28.6% were asymptomatic.

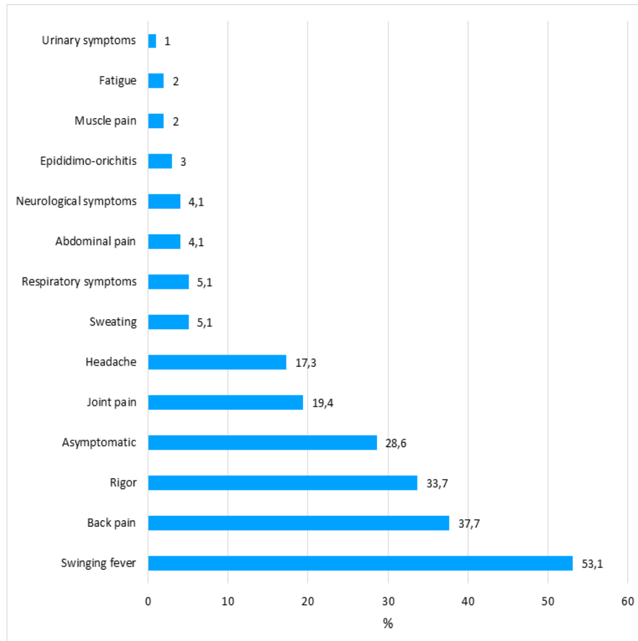

Figure 1. Frequency of symptoms recorded among Brucellosis cases (n = 98)

Table 1. Results of Serum Agglutination Test (SAT) for Brucellosis reported in Arar City, Saudi Arabia, between 2020 and 2023 (n = 647)

SAT	Brucella abortus		Brucella melitensis	
	No.	%	No.	%
Undetectable	167	25.81	0	0.00
<1:80	408	63.06	438	67.70
1:80	7	1.8	99	15.30
1:160	17	2.63	33	5.10
1:320	26	3.25	40	6.18
1:640	21	3.24	31	4.79
1:1280	0	0.00	5	0.77
1:2560	1	0.15	1	0.15

A titer of ≥ 1:320 was considered positive for Brucellosis, and a titer of 1:160 was considered positive if associated with clinical evidence of Brucellosis.

Table 2. Trend in Brucellosis cases* between 2020 and 2023 in Arar City, Saudi Arabia

Year	Number of samples examined	Positive for Br. abortus		Positive for Br. melitensis		Positive for Br. Abortus and Br. melitensis		Total positive cases of Brocellosis	
		No.	%	No.	%	No.	%	No.	%
2020	292	1	0.34	19	6.51	31	10.62	51	17.46
2021	204	0	0.00	12	5.88	14	6.86	26	12.74
2022	141	0	0.00	11	7.80	9	6.38	20	14.18
2023	10	0	0.00	0	0.00	1	10.00	1	10.00
Total	647	1	0.15	42	6.49	55	8.50	98	15.15

*A titer of ≥ 1:320 was considered positive for Brucellosis, and a titer of 1:160 was considered positive if associated with clinical evidence of Brucellosis

Table 3. Frequency distribution of Brucellosis cases by gender, age, and nationality

		2020 (no.=51)		2021 (no.=26)		2022 (no.=20)		2023 (no.=1)		Total (no.=98)	
		No.	%	No.	%	No.	%	No.	%	No.	%
Gender	Female	10	19.61	5	19.23	2	10.00	0	0.00	17	17.35
	Male	41	80.39	21	80.77	18	90.00	1	100.00	81	82.65
Age (years)	10-	1	1.96	1	3.85	2	10.00	0	0.00	4	4.8
	20-	12	23.53	9	34.62	7	35.00	0	0.00	28	28.57
	30-	16	31.37	11	42.31	6	30.00	1	100.00	34	34.69
	40-	13	25.49	3	11.54	1	5.00	0	0.00	17	17.35
	50-	3	5.88	1	3.85	3	15.00	0	0.00	7	7.14
	60-	4	7.84	1	3.85	1	5.00	0	0.00	6	6.12
	70-	2	3.92	0	0.00	0	0.00	0	0.00	2	2.4
Nationality	Saudi	24	47.06	6	23.8	8	40.00	0	0.00	38	38.77
	Sudanese	19	37.25	17	65.38	11	55.00	1	100.00	48	48.98
	Indian	5	9.80	0	0.00	0	0.00	0	0.00	5	5.10
	Bangladesh	1	1.96	1	3.85	1	5.00	0	0.00	3	3.6
	Syrian	1	1.96	0	0.00	0	0.00	0	0.00	1	1.2
	Egyptian	1	1.96	1	3.85	0	0.00	0	0.00	2	2.4
	Kenya	0	0.00	1	3.13	0	0.00	0	0.00	1	1.2

Discussion

Brucellosis remains the most spread zoonotic disease. However, WHO ranked it as the seventh most neglected disease in endemic areas [12, 13]. This research offers a clear insight into the epidemiological trends, clinical presentations, and complications of human brucellosis in the Northern Border region of Saudi Arabia.

Prevalence of detected cases

We observed a consistent downward trend in the detected cases throughout the study duration. This finding aligned with the global decline in cases. Notably, the reported cases in Spain declined from 514 cases in 2000 to 75 in 2015 [14]. Likewise, Al Shehhi et al. reported that the overall crude notification rate was 3.3 per 100,000 population in the United Arab Emirates, indicating a decrease in the incidence of cases from 135 to 75 per 100,000 population from 2012 to 2015 [15]. This decline could be attributed to the comprehensive efforts of the Saudi national interventions to eliminate brucellosis by raising the awareness of healthcare providers and the population regarding the disease, risk factors, and prevention policies like hand hygiene in addition to livestock vaccination campaigns as a control measure among animals to prevent transmission to humans [4]. The distribution of Brucella species observed during the study indicated a shift, with a higher prevalence of positive tests for Br. melitensis compared to Br. abortus. This finding aligns with the livestock demographics reported by the Saudi Ministry of Agriculture in 2020, which stated that sheep and goats—known reservoirs of Br. melitensis—constitute over 90% of the Kingdom's livestock, while cattle, the primary reservoir for B. abortus, account for only 3% [16, 17].

Demographics of the patients

The predominance of male patients (82.65%) in this study is consistent with findings from another research conducted in Saudi Arabia. Alkahtani et al. similarly reported that males constituted most brucellosis cases in a study conducted in southern Saudi Arabia, largely due to their engagement in high-risk occupations such as farming and livestock handling [11]. Moreover, the limited educational opportunities for women in the agricultural sector may further explain this trend. Additionally, cultural norms in Saudi society, particularly in rural areas, restrict women's participation in farming activities, thereby reducing their exposure to potential sources of infection. The age distribution in this study, with most cases occurring in the 30-40 years, agrees with the results of Alkahtani et al., who reported a similar age-related risk, as individuals in this age group are more likely to engage in outdoor work and have greater exposure to livestock [11].

Clinical manifestations of patients

The most common symptoms observed in the current study were swinging fever, back pain, rigor, and joint pain, which are consistent with findings from previous studies by Elmoselhy et al. on the Egyptian population [18], and Alsayed et al. conducted a study on brucellosis in Syria [19]. What is notable about this result is that almost one-third of the cases were asymptomatic carriers. This underscores the importance of implementing large-scale screening among high-risk individuals to prevent the spread of the disease.

Strengths and Weaknesses

Our study has several strengths and limitations. The first strength is that it covers a comprehensive time (2020-2023), providing a detailed overview of the epidemiological trends of brucellosis in the Northern Border region of Saudi Arabia. Secondly, we recruited a relatively large sample size (647 subjects), which supports the generalizability of the findings and allows for a more accurate representation of brucellosis in this region. Thirdly, the study focused on asymptomatic cases, which are often underreported but play a significant role in disease transmission. However, our limitation is that the reliance on the retrospective design made us limited to the data in records only and couldn't recruit more data from the patients to avoid recall bias. Furthermore, SAT was used as a primary diagnostic tool, which may have lower sensitivity and specificity compared to molecular techniques such as Polymerase Chain Reaction (PCR) and the modern automated blood culture, potentially leading to underdiagnosis, especially in chronic or asymptomatic cases. However, SAT remains the main diagnostic tool in developing countries [20]. Finally, the study did not follow up on the patients for relapse rates and chronic complications. Further research should be conducted to assess long-term complications of patients to understand the disease progression. Despite limitations, this study offers additional insight into the brucellosis trend in KSA and the clinical manifestations of patients.

Conclusion

Overall, the trend was comparable to the global rates, with predominance for males aged 20-40 years, which confirms the success of the national public health interventions and highlights the importance of spreading awareness campaigns and conducting surveillance systems among high-risk individuals and livestock to prevent transmission and facilitate case detection, particularly in asymptomatic patients.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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