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# Epidemiological Features and Clinical Presentations of Brucellosis: A Retrospective Investigation of 160 Patients in Xinjiang Province of China

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## Abstract

Brucellosis remains prevalent in developing countries and results in substantial economic losses and human morbidity. The number of brucellosis cases increased in southeast Xinjiang provinces of China in recent years; however, the clinical epidemiological features of brucellosis in here are unclear. In this study, 160 patients with brucellosis in Bazhou People's Hospital between January 2014 and June 2015 were studied. The diagnosis was determined by clinical findings, and positive agglutination titer etc. Epidemiological investigation showed that Uighur ethnicity comprised 51.3% of all cases, and Han (37.5%), Mongolian (6.9%), Hui (3.1%), and Miao (1.3%). We divided all cases into four age groups: Junior (5.0%), adult 31.3%, middle-age 52.5% and senior 11.3%. Evidently, middle-age group was the majority. In additions, our investigation into the disease seasonal distribution showed the prevalence of brucellosis took place in summer months. According to the duration of symptoms, the investigated cases were grouped into acute (127 cases), sub-acute (27 cases), and chronic (6 cases) brucellosis. The most common symptom was fever (86.3%), followed by arthralgia (54.4%), headache (41.9%), sweating (27.5%) and cough (23.1%) etc. Taken together, the frequency of brucellosis appears to differ, depending on ethnicity, gender, season, age group, as well as involvement of professional occupation.

## 1. Introduction

Brucellosis is one of the most severe infected diseases, with more than 500, 000 new brucellosis cases per year issued by The World Health Organization (WHO). Despite having been brought under control in many developed countries, the disease remains prevalent in developing countries and results in substantial economic losses and human morbidity [1, 2]. In fact, China is among the affected countries. During the past decades, human brucellosis incidence in China has risen by 10% per year and more than 46,000 new cases were reported in 2013 by the Chinese Center for Disease Control and Prevention (CDC) [3-5]. It is noteworthy that Brucellosis incidence varies significantly within China and high incidences occur in some endemic areas including Inner Mongolia, Shanxi,

Heilongjiang, Jilin, Hebei, and Xinjiang provinces [6, 7], where the incidence ranges between 50 and 1395 per 100,000 population. Therefore, there is no doubt that brucellosis is a major public health concern in China especially in endemic areas.

Brucellosis occurs primarily due to infection of *Brucella* spp into human body. The infection usually results from either consumption of contaminated animal products, such as unpasteurized milk, or direct contact with tissues or blood from infected animals [8]. Thus, individuals with occupations related to raising domestic animals in endemic areas, such as farmers, shepherds and veterinarians, constitute a aggregated population with a high potential risk [9, 10]. In addition to occupational risk, the disease appears to display age preference, evidenced by extensive research revealing that brucellosis mainly affects young and middle-aged populations, while leaving the old counterpart slightly affected [11, 12].

Symptoms of brucellosis are non-specific including fever, sweating, malaise, headache, back pain, loss of appetite. Involvement of any organ is often referred to localized disease and diagnosed as a complication. According to the duration of the symptoms, brucellosis cases are classified as "acute" (less than eight weeks), "sub-acute" (from eight to 52 weeks), and chronic (more than 52 weeks) [13]. Most brucellosis cases are determined as acute brucellosis, marked by intermittent or remittent fever; headache, arthralgia, and backache are the other symptoms of acute brucellosis. Sub-acute brucellosis is a typical form with undulant fever and the mild symptoms of this form include fatigue, headache and myalgia. Chronic brucellosis, which accounts for a small fraction of brucellosis cases, is able to result in complications such as arthritis, endocarditis, spondylitis, sacroiliitis [10, 14]. Although there are a number of research studies on brucellosis across the world, few relevant research studies are conducted in China [15], let alone conducting studies in systematic manner.

## 2. Objectives

In this study, we received 160 brucellosis cases from Bazhou people's hospital between January 2014 and June 2015, and carried out a retrospective study of the cases in systematic manner. By comparison between our epidemiological & clinical data and those from relevant published articles, we expected to reveal the distinctive features of brucellosis prevalence in an endemic area of China. Our findings may contribute to the better understanding of epidemiology of brucellosis, and the prevention & control of the disease.

## 3. Patients and Methods

### 3.1. Patients

A total of 160 brucellosis cases collected from the Bazhou People's Hospital between January 2014 and June 2015 were

investigated. A retrospective study was undertaken and the patient files were investigated for their history, clinical and laboratory findings, as well as clinical outcomes and complications.

### 3.2. Case Ascertainment

Brucellosis was diagnosed on the basis of one of the following criteria: (1) isolation of *Brucella* spp in blood, bone marrow, or cerebrospinal fluid (CSF) and other body fluids or tissue samples; (2) a compatible clinical presentation, such as arthralgia, fever, sweating, chills, and headache, combined with two serological tests including Rose Bengal plate test (RBPT), and a further test, the standard tube agglutination test (SAT), with titers of 1:160 or greater being determined as positive [16].

### 3.3. Case-Grouping Procedures

Cases were divided into three groups based on their histories, symptoms, and clinical presentation times: acute brucellosis (<8 weeks), sub-acute brucellosis (8–52 weeks), and chronic brucellosis (>52 weeks). Meanwhile, patients were classified into four age groups: junior (<20 years), adult (20–40 years), middle-age (40–60 years), and senior (> 60 years). All cases underwent routine laboratory tests by automated culture identification system, BACTEC 9240 (Becton–Dickson Diagnostic Instrument System, Franklin Lakes, NJ, USA). Blood, bone marrow, CSF, arthrocentesis fluid, and abscess cultures were taken from patients.

### 3.4. Treatments

Patients were treated with various combinations of antibiotics. The regimens included the following: oral doxycycline (100 mg every 12 h), oral rifampin (300 or 600 mg every 24 h), intramuscular streptomycin (1 g every 24 h), oral ciprofloxacin (500 mg every 12 h), and cotrimoxazole (80/400 or 160/800 every 12 h). If required, the duration of therapy was extended. All patients were followed up for at least 2–3 weeks during hospitalization. Outpatients were called for control visits at 2-week intervals. All patients were followed up for at least 6 weeks after completing therapy.

### 3.5. Statistical Analysis

The obtained data were analyzed using the Statistical Package for the Social Sciences (SPSS). One-way ANOVA and post-hoc tests were used for multiple comparisons. In addition, the  $\chi^2$ -test and Fisher's exact tests (when appropriate) were used for categorical variables, and Student's t-test was used to compare mean values. Differences in the p value of <0.05 were considered significant.)

## 4. Results

### 4.1. Epidemiological Features of the 160 Brucellosis Cases

160 brucellosis cases of bazhou people's hospital were

investigated in this study. The epidemiological findings of the cases were summarized in Table 1. 124 patients (77.5%) were males and 36 (22.5%) females. The male to female ratio was 4.85:1. The mean age was (44.0±14.2). The majority of the patients were (82, 51.3%) Uighur ethnicity, and then 60 (37.5%) Han, 11(6.9%) Mongolian, 5(3.1%) Hui, and 2(1.3%) Miao. According to their ages, the patients were divided into four groups: junior (<20 years), adult (20-40 years), middle-age (40-60years), and senior (> 60 years). Junior group accounted for 5.0% (8 cases), adult 31.3% (50 cases), middle-age 52.5% (84 cases), and senior 11.3% (18 cases). It appears that the disease is more likely to occur among the middle age population. In addition, the ratios of male to female among the age groups were 7:1, 4:1, 3.2:1, and 2.6:1 respectively. As brucellosis prevalence is believed to have a preference in season, we next investigated whether the disease

prevalence varied in seasons over the entire year of 2014. It was obvious that more number of cases occurred in summer (49 cases) than in other seasons (spring (26 cases), autumn (22 cases), winter (11 cases) respectively (Figure 1). Various risk factors linked to Brucellosis have been documented in decades, and professional occupations in particular reported mostly [17]. Here, we analyzed the effect of occupation on the patients. As shown in Table 1, herdsmen rank highest in the cases, accounting for 58.1%; animal-breeders reach runner-up spot with 13.1%. Intriguingly, among the investigated groups, the unemployed ranked third with 6.9%. These findings suggest Professional occupations exposure to animals have potential links to brucellosis. Acute brucellosis group contained 127 patients (79.4% of total cases), sub-acute 27 patients (16.9%), and chronic 6 patients (3.8%), indicating most patients with brucellosis present acute form.

**Table 1.** Epidemiological investigation into 160 cases of brucellosis from Bazhou people's hospital between January 2014 and June 2015.

Characteristics of patients	Male (n=124) No.(%)	Female (n=36) No.(%)	Total (n=160) No.(%)
Mean age±SD(yr)	43.3±14.5	46.3±12.9	44.0±14.2
Ethnicity			
Uighur	62(50.0%)	20(55.6%)	82(53.1%)
Han	52(41.9%)	8(22.2%)	60 (37.5%)
Inner Mongolian	7(5.6%)	4(11.1%)	11(6.9%)
Hui	2(1.6%)	3(8.3%)	5(3.1%)
Miao	1(0.8%)	1(2.8%)	2(1.3%)
Age group			
Junior	7(5.6%)	1(2.8%)	8(5.0%)
Adult	40(32.3%)	10(27.8%)	50(31.3%)
Middle-age	64(51.6%)	20(55.6%)	84(52.5%)
Senior	13(10.5%)	5(13.9%)	18 (11.3%)
Occupations			
Herdsmen	73(58.9%)	20(55.6%)	93(58.1%)
Animal-breeder	16(12.9%)	5(13.9%)	21(13.1%)
veterinarian	7(5.6%)	1(2.8%)	8(5.0%)
Hospital staff	0(0.0%)	1(2.8%)	1(0.6%)
Unemployed	7(5.6%)	4(11.1%)	11(6.9%)
Others	21(16.9%)	5(13.9%)	26(16.3%)
Clinical type			
Acute	101(81.5%)	26(72.2%)	127(79.4%)
Subacute	19(15.3%)	8(22.2%)	27(16.9%)
Chronic	4(3.2%)	2(5.6%)	6(3.8%)

Note: others include multiple occupations such as teacher, student, police officer and politician etc.

#### 4.2. Clinical Presentations of the 160 Cases

Table 2 lists the main symptoms and findings noted on clinical presentation. The most common clinical presentations were fever (138 cases, 86.3%) and then headache (69, 41.9%), sweating (44, 27.5%), and other clinical presentations were less frequently observed. It

deserved mention that most fever cases showed intermittent fever. The frequency of the clinical presentations between two genders showed no significant difference. Moreover, we observed muscular soreness (17, 10.6%) splenomegaly (9 cases), hepatomegaly (2 cases), orchitis (6 cases, 3.75%), prostatitis(1 cases), bronchitis ( 28 cases, 17.5%).

**Table 2.** Clinical manifestation in the 160 cases of brucellosis.

Clinical symptoms	Male (n=124) No.(%)	Female (n=36) No.(%)	Total (n=160) No.(%)
Fever	109(87.9%)	29(80.6%)	138(86.3%)
Headache	53(42.7%)	14(38.9%)	67(41.9%)
Sweating	35(28.2%)	9(25.0%)	44(27.5%)
Nausea /vomit/diarrhea	13(10.5%)	6(16.7%)	19(11.9%)
Cough	30(24.2%)	7(19.4%)	37(23.1%)
Chill	3(2.4%)	0(0.0%)	3(1.9%)
Back pain	25(20.2%)	9(25.0%)	34(21%)
Arthralgia	67(54.0%)	20(55.6%)	87(54.4%)
Painful and swollen testis	6(4.8%)	0	6(3.75%)
Muscular soreness	14(11.3%)	3(8.3%)	17(10.6%)
Hepatomegaly	2(1.6%)	0(0.0%)	2(1.3%)
Splenomegaly	6(4.8%)	3(8.3%)	9(5.5%)
Orchitis	6(4.8%)	0	6(3.75%)
Prostatitis	1(0.8%)	0	1(0.63%)
Bronchitis	19(15.3%)	9(25.0%)	28(17.5%)

Laboratory test results are presented in Table 3. Lymphocytosis was found in 47 patients (29.4%), anemia in 13 patients (8.1%), thrombocytopenia in 7 patients (4.4%). In addition, the elevated activities of typical aminotransferases and other indicator enzymes were observed. Various initial

regimens were administered to the 160 patients with brucellosis, and all patients were followed up for one year. The overall relapse rate in the patients was 2.5% (4 cases) and they had been transferred to another hospital for treatment.

**Table 3.** Laboratory test results on the 160 cases of brucellosis.

Laboratory findings	Male (n=124) No.(%)	Female (n=36) No.(%)	Total (n=160) No.(%)
Lymphocytosis(>45%)	32(25.8%)	15(41.7%)	47(29.4%)
Anemia(hemoglobin<12mg/dl)	4(3.2%)	9(25%)	13(8.1%)
Thrombocytopenia<15×104/mm3	5(4.0%)	2(5.6%)	7(4.4%)
Positive agglutination titer(≥1:160)	98(79.0%)	34(94.4%)	132(82.5%)
Elevated AST	42(33.9%)	13(36.1%)	55(34.4%)
Elevated ALT	54(43.5%)	12(33.3%)	66(41.3%)
Elevated GGT	22(17.7%)	3(8.3%)	25(15.6%)

AST: aspartate aminotransferase, ALT: alanine aminotransferase  
GGT: gamma-glutamyl transferase.

## 5. Discussion

Brucellosis is the most frequent zoonotic infectious disease around the world, affecting more than 500,000 people annually [18]. Recently, brucellosis cases have spread quickly and increased sharply in China [19]. Ba zhou, a prefecture of Xinjiang Uygur Autonomous Region, is located in Brucella-endemic areas of northern China. Our brucellosis cases were collected from Ba zhou people's hospital, a prestigious regional hospital that serves a population of nearly 1.3 million of the prefecture. Using these cases, we initially carried out a small-scale retrospective investigation into the 160 cases, in an attempt to systematically evaluate epidemiological features, as well as clinical and laboratory findings of the patients. Although a number of studies of brucellosis were conducted around the world, only few such relevant studies are carried out in China. To our knowledge, this is the first systematic retrospective study investigating brucellosis in an endemic area of China.

Whether male gender preference is associated with brucellosis remains disputable. Higher incidence of brucellosis is observed in males than in females [20], whereas several published reports suggest that the two genders are affected equally by the disease [21-23]. In this

study, our results showed that more males were affected compared with females, and this difference is statistically significant ( $p < 0.05$ ). Furthermore, this gender preference appears to exist in each age group (Table 1), though the ratios of male to female varied—7:1, 4:1, 3.2:1, and 2.6:1 respectively. Of note, the majority of our investigated patients consist of herdsmen and animal-breeders, with the proportion of two professionals combined reaching up to 71.2%. These populations probably due to regularly contact with livestock are at higher risk of brucellosis [24]. Plus, the two occupations in China are taken up by men rather than women. Thus, higher incidence of brucellosis present in our men group could attribute to the general state's context where more men are involved in the livestock-related work.

Most brucellosis cases occurs in the spring and summer months. Gur et al reported that 68% of cases presented in the spring and summer [25]. Savas et al observed the highest presentation in July and the lowest in January [26]. Lulu et al [27] showed that 78% of the cases were observed in the March–July period, peaking in April–May. Roushan et al [17] showed that 25.2% of cases occurred in spring, 40.1% in summer, 22% in autumn, and 12.8% in winter months. In this study, a clear seasonal variation in the number of cases has been revealed. We observed over the entire year of 2014 (108 cases in total) that 24.1% of our cases (11 cases) occurred in

spring, 45.4% (49 cases) in summer, 20.4% (22 cases) in autumn and 10.2 % (11 cases) in winter (Figure 1). The total number of cases in spring and summer does not account for the majority; combined cases in summer and autumn instead reached the highest (Figure 1). Furthermore, our observation showed that the highest frequency of brucellosis occurred in June and the lowest in November. Though we did not observe that the number of brucellosis cases was at its maximum in July as reported by savas et al [26], there is no difference in brucellosis cases between June and July ( $P>0.05$ ), suggesting our findings, although being not

identical with, still support earlier other's research. Our results shown in (Figure 1) indicated that most brucellosis cases occurred in the May-August (64 cases, 59.3 %), coinciding with local livestock breeding season. Taken together, despite our aforementioned findings slightly diverging from some epidemiological studies in other endemic regions, our findings are largely in agreement with the previous studies. The reason for the divergence may be due to distinctive regional factors such climate, moisture, environment, and animal breeding time etc.

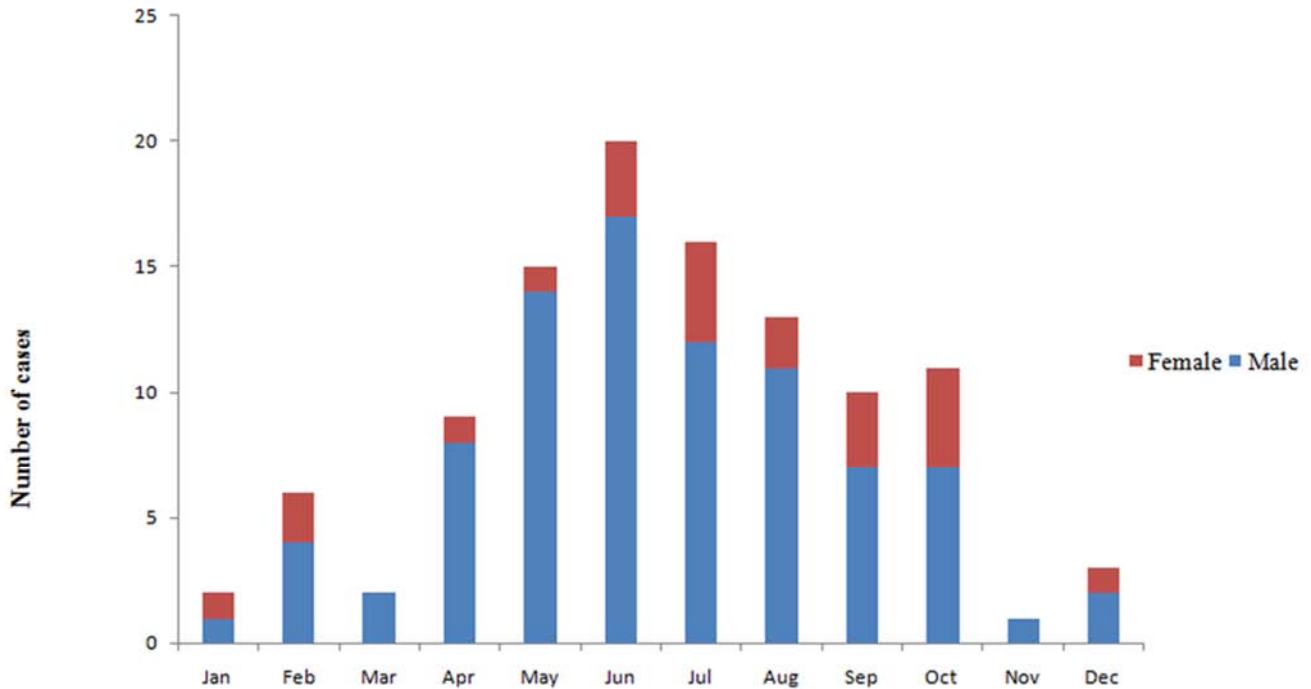


Figure 1. Monthly distribution of brucellosis in Bazhou people's hospital in 2014.

In endemic areas, brucellosis shows a high frequency in the 15–35 years age group [28]. Some epidemiological studies have indicated relatively younger ages. This may be attributed to involvement in the raising of livestock starting at a younger age in some areas [16]. In this study, patients with age range 41-60 comprised 52.5%, the highest percentage among age groups. Our findings are in accordance with some reports [17, 26, 29-31], suggesting in some endemic areas, higher age population may constitute high-risk population, and should not be neglected. The reason for the increased age phenomenon in our findings might attribute to involvement in livestock raising at an older age.

Brucellosis is conventionally divided into three forms, including acute, sub-acute, and chronic. In this study, the acute brucellosis were comprised of most cases (79.4%), whereas sub-acute and chronic cases roughly accounted for 16.9% and 3.8% respectively; These findings are in agreement with previous reports [27, 32, 33]. Furthermore, only 3.8% of chronic brucellosis cases may explain low frequency of complications as chronic brucellosis constitutes the main cause for complications, such as

arthritis, and orchitis etc [14, 34].

## 6. Conclusion

In closing, multiple epidemical features of brucellosis have been comprehensively investigated and the data presented in this study strongly link occurrence of the disease to ethnicity, age range, as well as professional occupation. Our work might provide novel, geographic insight in the disease prevention and control in China and in particular some areas of China where Brucellosis remains prevalent.

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