Epidemiological and Clinical Features of Brucellosis in Hospitalized Patients in Kosovo

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Abstract

Background: Brucellosis is recognized as a clinical and health problem in underdeveloped countries. This research is a descriptive study to present the epidemiological features, clinical aspects and laboratory results of hospitalized patients in the University Clinical Center of Kosova, Infectious Diseases Clinic in Prishtina in a six-year period.

Materials and Methods: 124 hospitalized patients with confirmed brucellosis were included in the study. Sociodemographic, clinical, diagnostic and data regarding the treatment were collected from patients' medical records. A serological test was used for diagnosis of the disease.

Results: The mean age of patients was 30.78±17.24 years with a range 2-74 years. 44 (35.5%) of them were females and 80 (64.5%) males, p<0.01. Most affected age groups were 11-20 years old. The highest brucellosis rate was observed in children and students (30.6%). Osteoarticular manifestations were the most common forms of localized disease, which affected 44.45 % of patients. A combination of streptomycin and doxycycline the first three weeks, continuing rifampicin and doxycycline was the most applied treatment protocol.

Conclusion:

The majority of patients with brucellosis in this study were attributed to direct contact with animals. Osteoarticular manifestations were the most common forms of localized disease.

INTRODUCTION

Brucellosis is one of the world's most widespread zoonoses1 caused by gram-negative bacilli of the genus Brucella (Brucella abortus, B. suis, B. melitensis and B. canis)2. Brucellosis in humans (mainly caused by B. abortus and B. melitensis), is characterized by continued, intermittent or irregular fever, headache, weakness, profuse sweating, chills, arthralgia, depression, weight loss and generalized aching. In the countries where food hygiene prevents food-borne brucellosis, the disease is largely occupational and the majority of cases are males between the ages of 20 to 45 years. In the populations where food-borne brucellosis is common, such as nomadic societies, children account for a high proportion of acute cases3.

Brucellosis in animals presents a subacute to chronic disease affecting a range of domestic and wildlife species and is a leading cause of abortion in livestock4. It is a systemic disease that can involve any organ or system of the body. However, the most common manifestation is fever. Human brucellosis usually manifests as an acute or subacute febrile illness which may persist and progress to a chronic form5.

Generally, human infection occurs through consumption of poorly prepared meat and dairy products in the form of milk, cheese and butter but can also arise through exposure to animals and carcasses due to occupation6. In humans, brucellosis caused by B. melitensis, which mainly causes infection in goats and sheep, is the most clinically obvious7. The region of Prizren in southern part of the Kosovo is already an endemic zone and it is anticipated an upward trend of frequency occurrence of brucellosis in coming years8. In a large cross-sectional survey of the seroprevalence of brucellosis in sheep, goats and cattle in Kosovo the seropositive animals were found in 25 per cent (19 to 32 per cent) within 162 villages surveyed. Brucella

melitensis predominates as the cause of brucellosis in ruminants in Kosovo9. Brucellosis is a major concern for most of the countries in the Balkans. In 2008 the incidence in Serbia is reported to be 3.3 per 100 000. In Macedonia, an incidence of 18.6 and 24 per 100 000 was reported in 2007 and 2008, respectively10,12. In Albania, an incidence of 25 per 100 000 inhabitants was reported in 200813. In 2009 in Bosnia and Herzegovina, the incidence increased from 3.8 to 33.43 per 100 00014.

The cross border migration of people and animals between these countries facilitates the spread of old and creates new zooanthroponotic foci of brucellosis in the region. Rural and peri-urban agriculture also carries risks, including that of increased transmission of zoonotic diseases15. Possible major source of infection with brucellosis might include marketed foods in urban and peri-urban areas, and contacts with animals and home consumption in rural areas.

MATERIALS AND METHODS

This is a descriptive study performed on 124 hospitalized patients with Brucellosis at the Infectious Diseases Clinic, University Clinical Center of Kosova in Prishtina during the period from January 2006 until the end of December 2011. For each patient, a blood sample was collected and tested by the Wright test. Positive criterium for the Wright was the titer 1/80.

Treatment protocols in our study included: streptomycin 1g/day or gentamycin 3-5 mg/kg daily administered for the first three weeks with rifampicin15-20 mg/kg (maximum 600-900mg/day) continuing by rifampicin in combination with doxycycline 2-4 mg/kg per day (maximum 100 mg administered orally twice daily for six weeks), or trimethroprim 10 mg/kg per day; sulfamethoxazole, 50mg/kg per day divided in 2 doses. For children the initial combination was gentamycin and trimethroprim/sulfamethoxazole followed by rifampicin and trimethroprim sulfamethoxazole. Efficacy of treatment was determined by rates of failure or relapse with a follow-up period of two years. After treatment, all patients were evaluated at two weeks and 1 month intervals and whenever clinical symptoms reappeared.

STATISTICAL ANALYSIS

Statistical analysis of data was performed using SPSS for Windows version 18.0. Descriptive statistics, were used to describe demographic data, and clinical data. Pearson's Chi-square test was used to compare qualitative clinical data between patients. The t-test was used to compare the age between males and females. A p-value ≤ 0.05 was considered as a significant result.

RESULTS

Overall 124 hospitalized patients were included in the study. The mean age of patients was 30.78 ±17.24 years with a range 2–74 years. 44 (35.5%) of them were females and 80 (64.5%) males, p<0.01 (table 1).

Table 1

Epidemiological findings in 124 patients with brucellosis

Characteristics of patients	Male (n=80) No. (%)	Female (n=44) No. (%)	Total n=124 No. (%)
Mean age ± S.D. (yr)	31.23 ± 17.18	29.98 ± 17.51	30.78 ± 17.24
Resident			
Urban	25 (31.3)	16 (36.4)	41 (33.1)
Rural	55 (68.7)	28 (63.6)	83 (66.9)
Seasonal distribution			
Spring	24 (30.0)	9 (20.4)	33 (26.6)
Summer	29 (36.2)	16 (36.4)	45 (36.3)
Autumn	18 (22.5)	12 (27.3)	30 (24.2)
Winter	9 (11.3)	7 (15.9)	16 (12.9)
Risk factors	53 (66.2)	26 (59.1)	79 (63.7)
Direct contact	49 (61.2)	16 (36.4)	65 (52.4)
Ingestion	4 (5.0)	10 (22.7)	14 (11.3)
Without risk factors	27 (33.8)	18 (40.9)	45 (36.3)
Clinical type			
Acute	63 (78.7)	36 (81.8)	99 (79.8)
Subacute	15 (18.8)	7 (15.9)	22 (17.7)
Chronic	2 (2.5)	1 (2.3)	3 (2.4)

The mean age of females was 29.98±17.51 years while the mean age of males was 31.23 ±17.18 years, without a significant difference between them. In urban area live 33.1% of patients with a significant difference with rural area where live 66.9% of patients, p<0.01.

Seasonal distribution was highest during summer with 36.3% followed by spring 26.6% of patients. Infection was transmitted in highest frequency by direct contact with animals in 52.4% patients, lowest number by ingestion et11.3% of patients with a significant difference between this to groups, followed by patients with unknown risk factor 63.7%. The disease was acute in 79.8% of the patients, sub acute in 17.7% and chronic in 2.4% of the patients (Table 1).

Figure 1

Distribution of patients by age group
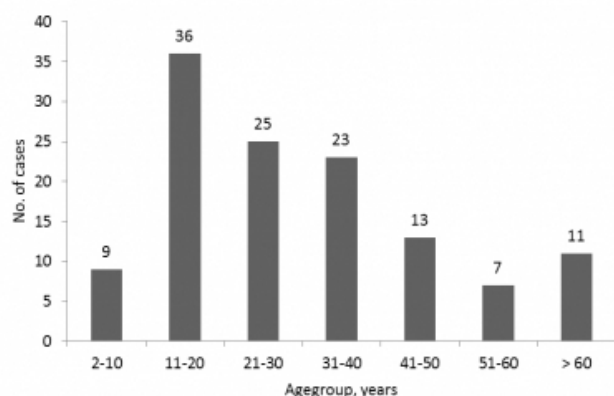
Patients ≤ 40 years of age account for 75 % of the total hospitalized patients. The highest frequency was observed among the age group of 11-20 year-old patients with a significant difference with other age groups. The mean duration of hospitalization was 28.7 ± 18.7 days (range 2-83). Most affected were pupils and students 30.6% followed by housekeepers 19.4%, farmers and animal husbandry 6.5%, veterinary and veterinary technicians 1.6% (Figure 1).

Table 2

Clinical manifestations in 124 patients with brucellosis

Clinical symptoms and signs	Male (n=80) No. (%)	Female (n=44) No. (%)	Total (n=124) No. (%)
Fever	49 (61.3)	19 (43.2)	68 (54.8)
Sweating	59 (73.8)	26 (59.1)	85 (68.6)
Fatigue	52 (65.0)	31 (70.5)	83 (66.9)
Artralgia	66 (82.5)	41 (93.2)	107 (86.3)
Headache	9 (11.3)	6 (13.6)	15 (12.1)
Nausea/Vomiting	18 (22.5)	11 (25.0)	29 (23.4)
Anorexia	47 (58.8)	26 (59.1)	73 (58.9)
Weight loss	7 (15.9)	3 (3.8)	10 (8.1)
Back pain	8 (10.0)	2 (4.6)	10 (8.1)
Splenomegalia	10 (12.5)	1 (2.3)	11 (8.9)
Hepatomegalia	15 (18.8)	4 (9.1)	19 (15.3)
Hepatosplenomegalia	23 (28.8)	10 (22.7)	33 (26.6)
Lymphadenopathy	17 (21.3)	17 (38.6)	34 (27.4)
Restricted joint movement	38 (47.5)	24 (54.5)	62 (50.0)
Icteric hepatitis	3 (3.8)	0 (0.0)	3 (2.4)
Osteoartic manifest.	36 (45.0)	19 (43.2)	55 (44.4)
Neurologic manifest.	6 (7.5)	4 (9.1)	10 (8.1)
Pulmonary involve.	22 (27.5)	8 (18.2)	30 (24.2)
Psychosomatic disord.	2 (2.5)	0 (0.0)	2 (2.5)
Depressive syndrome	0	2 (2.5)	2 (2.5)
Conjunctivitis	6 (7.5)	1 (2.3)	7 (5.6)
Cough	4 (5.0)	3 (6.8)	7 (5.6)
Cutaneous manifest.	4 (5.0)	0 (0.0)	4 (5.0)
Thrombosis v.fem./popl.	2 (2.5)	0	2 (2.5)
Orchiepididimitis	1 (1.3)	0	1 (0.8)

The most frequent clinical sign was artralgia in 86.3% of the patients; sweating 68.6%, fatigue 66.9%, anorexia 58.9% followed by fever 54.8% and restricted joint movement 50.0% in of the patients. Physical findings in abdominal examination include hepatosplenomegaly 26.6%,

hepatomegaly 15.3%, and splenomegaly 8.9%. Generalized lymphadenopathy occurred in 27.4% of all patients. Osteoarticular manifestations were the most common form of localized disease which affected 44.45 % of the patients. The largest number of patients (22) had hip synovitis followed by sacroillitis in 11 patients. Lumbosacral arthrosis was found in 6 patients, hip joint sclerosis in 4 patients and 1 patient had patellar sclerosis. Two patients were found with acute coxitis and 3 with coxarthrosis, 2 with spondylodisciitis, 1 osteomyelitis, 1 with vertebral L4 erosive sclerosis and spondyldisciitis, 1 with Th8-9 erosive sclerosis and 1 with spondylosis and fascet arthrosis.

Neurological impairment was found in 2 patients with acute serose meningitis, 2 with sensoro- motoric polyneuropathy and 6 with radicular lesions on the vertebral level L4/5/S1 of middle intensity. Routine chest X ray and auscultation revealed pathologic pulmonary findings in 24% of the patients caused by involvement of Brucellosis, with a dominant rate in male patients with 74%. The radiologic findings revealed pneumonia, bronchopneumonia, paratracheal lymphadenopathy and pleural effusion. Psychosomatic disorders were diagnosed in 2 male patients and 2 female patients with depressive syndrome. Bilateral conjuctivitis was present in 5.6% of the patients, maculopapulose exanthemas in 5.0%, and jaundice in 3.8%. One patient manifested thrombosis of VIC, VIE, VFC, VFP, VFS, VP, VSP on the left leg and 1 on the left popliteal vein. Orchiepididimitis was found in 1 patient (Table 2).

Of all124 patients two of them had a co-infection with Tularemia and one with chronic Hepatitis B.

Figure 2

Frequency of antibody titer with serologic method Wright.
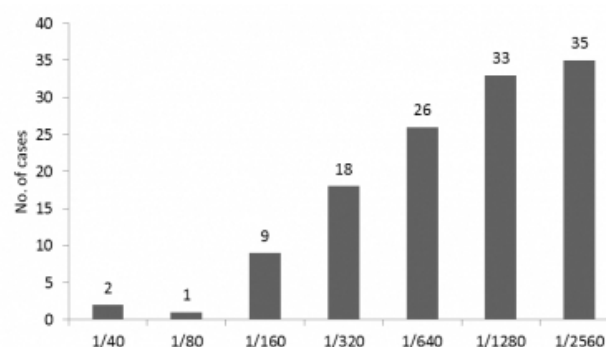
Positive Wright tests titer of 1/160 was observed in 7.3% of the patients, 1/640 in 20.96%, 1/1280 in 26.6% , and 1/2560 and 28.2% of the patients. The antibody titer below 1/80 was observed in 1.6% of the patients (Figure 2).

Six (4.8%) patients were also tested by ELISA IgM. One of them tested negative and five of them tested positive for IgM antibodies.

Table 3

Administered treatment

Treatment protocol	Frequency	%
Streptomycin- Doxycycline - Rifampicin	106	84.5
Gentamycin – TMP-SMX - Rifampicin	18	14.5

The most applied treatment was streptomycin 1g/day im once or twice daily (children 15mg/kg), rifampicin 15-20 mg/kg maximum 600-900mg/day (children 10-15 mg/kg) and doxycycline 2-4 mg/kg per day, (maximum 100 mg administered orally twice daily for six weeks) et 84.5% of patients, while gentamycin 3-5 mg/kg (children <8 years 1-2.5 mg/kg), trimethroprim10 mg/kg (children <8 years 6-8 mg/kg) per day sulfamethoxazole 50mg/kg per day divided in 2 doses (children <8 years 30-40 mg/kg) was the lowest prescribed treatment protocol et 14.5% (Table 3).

Patients with osteoarticular involvement received medical treatment for at least three months. We performed corticotherapy in 21 patients with osteoartcular complications. For children the initial combination was gentamycin and trimethroprim/sulfamethoxazole for 2 weeks continuing rifampicin plus trimethroprim sulfamethoxazole.

Two of the patients were pregnant patients and treated initially with cephtriaxon and rifampicin continuing the rifampicin with TMP-SMX. After delivery we tested two years later the patients and the babies which resulted with Wright titer negative.

DISCUSSION

 The results showed that the majority of patients were less than 40 years (75%) and 64.5% of them were male. The high risk groups includes the active population which is similar with other studies findings 5.

The vast majority of patients live in rural area. A significant number of families in rural communities breed cattle, sheep and goats. This shows that the majority of cases had a history of consumption of dairy products or contact with animal material. Brucellosis is often a disease of rural communities associated with animal husbandry. The prevalence of disease in domestic animals is an important predictor of disease in humans. Brucellosis is more common

in men than women 16,17,18. A high proportion of patients in our study (30.6%) were pupils and students followed by housewives and housekeepers, farmers, followed by veterinary and veterinary technicians. Possible explanations of this finding could be a greater risk of exposure amongst boys, with household responsibilities such as shepherding of livestock being preferentially delegated to boys.

The most common brucellosis signs are arthralgia, sweats, fatigue, anorexia, fever, and restricted joint movement.

Osteoarticular involvement, especially hip synovitis and sacroiliitis were the most common form of localized brucellosis. Many authors report similar findings with our study19,20 Hepatosplenomegaly and meningitis were more common among adults while respiratory symptoms were common among young patients. Epididymo-orchitis occurred only in one (1.9%) adult patient21,22,23,24. Neuropsychiatric symptoms were rarely reported in the documentation of the initial presentation of brucellosis, even though many patients had a prolonged duration of infection on presentation. In our study psychosomatic disorders were found in 2.5% and depressive syndrome in 2.5% of all adult patients25.

Almost all patients (81.5%) had an antibody titer higher over 1: 80 and 75.8% of the patients higher than 1:320 measured with the Wright method26. ELISA IgM was used only in 4.8% of patients. As a result, serologic tests with patients' history and disease status were used to diagnosis brucellosis27. Concerning the treatment there are some limitations in choosing the best regimen: there is a limited choice of antibiotics that act intracellular such as doxycycline and streptomycin. The prolonged treatment needed to prevent relapse may increase the occurrence of adverse events (including gastric discomfort, hepatotoxicity, nephrotoxicity, and allergic reactions and reduce adherence to the treatment28. Regimens that combine two or more antibiotics are now recommended by most experts due to high relapse rates with treatment with one type of antibiotic29.

The combination of streptomycin and doxycycline three weeks continuing doxycycline with rifampicin was the most prefered protocol in our study. The relapse rate in our study was 7.3% which is lower than in other studies that used gentamycin-doxycycline regimen30,31,32,33.

A limitation of our study is the use of only one diagnostic test. ELISA IgM was used only in 4.8% of the patients while

the blood culture method was not performed.

CONCLUSION

Brucellosis in this study was mainly attributed to direct contact with animals. Osteoarticular manifestations were the most common forms of localized disease

References

1. WHO: Seven neglected endemic zoonoses - some basic facts. Zoonoses and Veterinary Public Health WHO website; [http://www.who.int/zoonoses/neglected_zoonotic_diseases/en/] webcite

2. Young E: Brucella species. In Principles and practice of infectious diseases. Edited by Mandell G, Bennet JE, Dolin R. Philadelphia: Churchill-Livingstone; 2000:2386-2393.

3. Corbel MJ: Brucellosis in humans and animals. Geneva: World Health Organization; 2006.

4. Chin J: Control of Communicable Diseases Manual. 17th edition. Washington: American Public Health Association; 2000:624.

5. Dean AS, Crump L, Greter H, Hattendorf J, Schelling E, et al. (2012) Clinical Manifestations of Human Brucellosis: A Systematic Review and Meta-Analysis. PLoSNegl Trop Dis 6(12): e1929. doi:10.1371/journal.pntd.0001929

6. Minas M, Minas A, Gourgulianis K, Stournara A: Epidemiological and clinical aspects of human brucellosis in Central Greece. Jpn J Infect Dis 2007, 60:362-366.

7. Brucellosis: an Overview[Emerging Infectious Diseases * Volume 3 * Number 2 * April-June 1997]1st International Conference on Emerging Zoonoses

8. Muçaj S, Kabashi S, Gashi S, Kryeziu R, Hasani A. Topographic Expansion of Brucellosis in Kosovo . Mat Soc Med. 2009; 21(2): 75-81.

9. Jackson R, Pite L, Kennard R, Ward D, Stack J, Domi X, Rami A, Dedushaj I. Survey of the seroprevalence of brucellosis in ruminants in Kosovo. Vet Rec. 2004 Jun 12;154(24):747-51.

10. Epidemiological Characteristics of Brucellosis in Serbia, 1980-2008.Radovan Čekanac1, Jovan Mladenović1, ElizabetaRistanović, SrđanLazić Croat Med J. 2010; 51: 337-44

11. Donev D, Karadzovski Z. Epidemiology and socio-medical aspect of human brucellosis in the Republic of Macedonia, 1980-2008. Book of abstracts of MetaNET Project Thematic Scientific Conference. Brucelossis in SEE and Mediterranean Region. 2009 Nov 12-14; Struga, Republic of Macedonia. Skopje: Institute of Social Medicine, Faculty of Medicine, Ss Cyril and Methodius University; 2009.

12. Nikolovski B, Karadzovski Z, Kostovska J. 30 years of prevention and control of brucellosis in Macedonia. Book of abstracts of MetaNET Project Thematic Scientific Conference: Brucelossis in SEE and Mediterranean Region. 2009 Nov 12-14; Struga, Republic of Macedonia. Skopje: Institute of Social Medicine, Faculty of Medicine, Ss Cyril and Methodius University; 2009.

13. Mersinaj K, Bino S, Crilly J. A review of brucellosis control in Albania. Book of abstracts of MetaNET Project Thematic Scientific Conference. Brucelossis in SEE and Mediterranean Region. 2009 Nov 12-14; Struga, Republic of Macedonia. Skopje: Institute of Social Medicine, Faculty of Medicine, Ss Cyril and Methodius University; 2009.

14. Obradović Z, Balta S, Velić R. Brucellosis in Federation of Bosnia and Herzegovina – epidemiological aspect. Book of abstracts of MetaNET Project Thematic Scientific Conference. Brucelossis in SEE and Mediterranean Region. 2009 Nov 12-14; Struga, Republic of Macedonia. Skopje: Institute of Social Medicine, Faculty of Medicine, Ss Cyril and Methodius University; 2009.

15. Flynn K: An Overview of Public Health and Urban Agriculture: Water, Soil and Crop Contamination & Emerging Urban Zoonosis. Ottawa, Canada: IDRC; 1999:84. Cities Feeding People report vol. 30

16. ZaremaObradović, RamizVelić. Epidemiological Characteristics of Brucellosis in Federation of Bosnia and Herzegovina. Croat Med J. 2010 August; 51(4): 345–350. doi: 10.3325/cmj.2010.51.345

17. Taleski V, Zerva L, Kantardjiev T, Cvetnic Z, Erski-Biljic M, Nikolovski B, et al. An overview of the epidemiology and epizootology of brucellosis in selected countries of Central and Southeast Europe. Vet Microbiol. 2002;90:147–55. doi: 10.1016/S0378-1135(02)00250-X. [PubMed] [Cross Ref]

18. Bosilkovski M, Krteva L, Dimzova M, Kondova I. Brucellosis in 418 patients from the Balkan Peninsula: exposure-related differences in clinical manifestations, laboratory test results, and therapy outcome. Int J Infect Dis. 2007;11:342–7. doi: 10.1016/j.ijid.2006.10.002. [PubMed] [Cross Ref]

19. Pourbagher A, Pourbagher MA, Savas L, Turunc T, Demiroglu YZ, Erol I, Yalcintas D. Epidemiologic, clinical, and imaging findings in brucellosis patients with osteoarticular involvement.AJR Am J Roentgenol. 2006 Oct;187(4):873-80.

20. Bosilkovski M, Krteva L, Caparoska S, Dimzova M. Osteoarticular involvement in brucellosis: study of 196 cases in the Republic of Macedonia. Croat Med J. 2004 Dec;45(6):727-33

21. Arkun R, Mete BD. Musculoskeletal brucellosis. SeminMusculoskeletRadiol. 2011 Nov;15(5):470-9. doi: 10.1055/s-0031-1293493. Epub 2011 Nov 11.

22. Tsolia M, Drakonaki S, Messaritaki A, Farmakakis T, Kostaki M, Tsapra H, et al. Clinical features, complications and treatment outcome of childhood brucellosis in central Greece. J Infect. May 2002;44(4):257-62. [Medline].

23. Franco M, Mulder M, Gilman R, Smits H (2007) Human brucellosis. Lancet Infectious Diseases 7: 775–786 doi:10.1016/S1473-309

24. Andriopoulos P, Tsironi M, Deftereos S, Aessopos A, Assimakopoulos G. Acute brucellosis: presentation, diagnosis, and treatment of 144 cases. Int J Infect Dis. 2007;11:52–7. doi: 10.1016/j.ijid.2005.10.011. [PubMed] [Cross Ref]

25. Tasove Y, Saltoglou N, Sahin G, Aksu HSZ. Osteoarthricular involvement of brucellosis in Turkey. ClinRheumatol. 1999;18:214–219

26. Ghaydaa A. Shehata, Laila Abdel-Baky, HebaRashed, HusseinElamin. Neuropsychiatric evaluation of patients with brucellosis. Journal of NeuroVirology. January 2010, Volume 16, Issue 1, pp 48-55

27. Pappas G, Akritidis N, Bosilkovski M, Tsianos E. Brucellosis. New England Journal of Medicine 2005; 352 (22):2325–36

28. MassoudHajia, FatemehFallah, GoliAngoti, AbdollahKarimi, MohamadRahbar, LatifGachkar, BahramMokhtari, AnahitaSanaei, AbdolazizRastegarLari. Comparison of Methods for Diagnosing BrucellosisLab Medicine 2013 44:29-33;

29. Osoba AO, Balkhy H, Memish Z, Khan MY, Al-Thagafi A, Al Shareef B, Al Mowallad A, Oni GA. Diagnostic value of Brucella ELISA IgG and IgM in bacteremic and non-bacteremic patients with brucellosis. J Chemother. 2001 Apr;13Suppl 1:54-9.

30. Agalar, C., S. Usubutun, and R. Turkyilmaz. 1999. Ciprofloxacin and rifampicin versus doxycycline and rifampicin in the treatment of brucellosis. Eur. J. Clin. Microbiol. Infect. Dis. 18:535-538.

31. Ariza J, Bosilkovski M, Cascio A, Colmenero JD, Corbel MJ, et al. (2007) Perspectives for the Treatment of Brucellosis in the 21st Century: The Ioannina Recommendations. PLoS Med 4(12): e317. doi:10.1371/journal.pmed.0040317

32. Solera J, Espinosa A, Martinez-Alfaro E, Sanchez L, Geijo P, et al. (1997) Treatment of human brucellosis with doxycycline and gentamicin. Antimicrob Agents Chemother 41: 80–84.

33. HasanjaniRoushan MR, Mohraz M, Hajiahmadi M, Ramzani A, Valayati AA (2006) Efficacy of gentamicin plus doxycycline versus streptomycin plus doxycycline in the treatment of brucellosis in humans. Clin Infect Dis 42: 1075–1080.

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