



A Descriptive Study on Hematological Changes in Brucellosis Infected Individuals

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Brucellosis is a zoonotic organism that causes diseases in both animals and humans. Human contact with infected domestic animals is often a transmission route of Brucellosis infection. This infection affects hematological parameters of the patients. We carried this study to determine the changes in various hematological parameters in our study subjects.

Patients and Methodology:

This study was carried out in Nangarhar regional hospital and safi medical complex on 45 Afghani people from December 2018 up to December 2020. The study design was prospective.

A total of 45 patients (Cases) with confirmed diagnosis of Brucellosis on the basis of serology enrolled in the study. Complete blood count and Erythrocyte sedimentation rate studies are also performed. Considered hematological parameters includes Hemoglobin (Hb), White Blood Cell count (WBC), Platelet count (PLT) and ESR. As well interview was done with each patient and a questionnaire was used. The collected data was analyzed with Microsoft excel program Autosum statistics. Results. A total of 45 patients were enrolled. The mean age \pm SD of the patients under the study were (28.74 \pm 15.22) years. The most common hematological changes observed were; anemia (57.7%), thrombocytopenia (24%), leucocytosis (13.3%), pancytopenia (24.4%), lymphocytopenia (31.1%), lymphocytosis (55.5%) & leucopenia (40%). Erythrocyte sedimentation

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rate were elevated in about 66% of patients. Fever and headache were the most common presenting symptoms (73%) and (82%) respectively. Night sweats in (40%), joint pain (53%), muscle pain (53%) and lymphadenopathy in 46% of patients. Conclusion: This result of this study shows that Brucellosis commonly affects people of low socioeconomical states, female sex, uneducated, those consuming contaminated dairy products, peoples living in rural areas and those having consuming or contact with animal. Salmonella typhi causes changes in the hematological parameters due to involvement of bone marrow.

Keywords: *Brucellosis; hematological changes.*

1. INTRODUCTION

Brucellosis has been recognized in animals and humans since the early 20th century. Brucellosis a highly contagious zoonosis caused by ingestion of unpasteurized milk or undercooked meat from infected animals, or close contact with their secretions [1,2,3]. It is also known as undulant fever, Malta fever, and Mediterranean fever [4].

Brucella species are small, Gram-negative, nonmotile, nonspore-forming, rod-shaped (coccobacilli) bacteria. They function as facultative intracellular parasites, causing chronic disease, which usually persists for life. Four species infect humans: *B. abortus*, *B. canis*, *B. melitensis*, and *B. suis*. *B. abortus* is less virulent than *B. melitensis* and is primarily a disease of cattle. *B. canis* affects dogs [5,6]. *B. melitensis* is the most virulent and invasive species; it usually infects goats and occasionally sheep. *B. suis* is of intermediate virulence and chiefly infects pigs. Human symptoms include profuse sweating and joint and muscle pain.

Brucellosis in humans is usually associated with consumption of unpasteurized milk and soft cheeses made from the milk of infected animals—primarily goats, infected with *B. melitensis* and with occupational exposure of laboratory workers, veterinarians, and slaughterhouse workers [7]. Brucellosis induces inconstant fevers, miscarriage, sweating, weakness, anemia, headaches, depression, and muscular and bodily pain. Overall findings support that brucellosis poses an occupational risk to goat farmers with specific areas of concern including weak awareness of disease transmission to humans and lack of knowledge on specific safe farm practices such as quarantine practices [8].

The symptoms are like those associated with many other febrile diseases, but with emphasis on muscular pain and night sweats. The duration

of the disease can vary from a few weeks to many months or even years [9-11]. In the first stage of the disease, bacteremia occurs and leads to the classic triad of undulant fevers, sweating (often with characteristic foul, moldy smell sometimes likened to wet hay), and migratory arthralgia and myalgia (joint and muscle pain). Blood tests characteristically reveal a low number of white blood cells and red blood cells, show some elevation of liver enzymes. Gastrointestinal symptoms occur in 70% of cases and include nausea, vomiting, decreased appetite, unintentional weight loss, abdominal pain, constipation, diarrhea, an enlarged liver, liver inflammation, liver abscess, and an enlarged spleen [12].

The diagnosis of brucellosis relies on 1; Detection of DNA or RNA of organism by means of PCR (Polymerase chain reaction). 2; Demonstration of the agent: blood cultures in tryptose broth, bone marrow cultures: The growth of brucellae is extremely slow (they can take up to two months to grow) and the culture poses a risk to laboratory personnel due to high infectivity of brucellae. 2; Demonstration of antibodies against the agent either with ELISA or the 2-mercaptoethanol assay for IgM antibodies associated with chronic disease by means of tests like Rose Bengal Test. 3: Histologic evidence of granulomatous hepatitis on hepatic biopsy [13,14].

Definite diagnosis of brucellosis requires the isolation of the organism from the blood, body fluids, or tissues, but serological methods may be the only tests available in many settings. Positive blood culture yield ranges between 40 and 70% and is less commonly positive for *B. abortus* than *B. melitensis* or *B. suis* [15].

Dipstick assays are new and promising, based on the binding of Brucella IgM antibodies, and are simple, accurate, and rapid. ELISA typically uses cytoplasmic proteins as antigens [16]. PCR is fast and should be specific. Many varieties of

PCR have been developed (e.g. nested PCR, realtime PCR, and PCR-ELISA) and found to have superior specificity and sensitivity in detecting both primary infection and relapse after treatment [17]. Other laboratory findings include normal peripheral white cell count, and occasional leucopenia with relative lymphocytosis [18]. As in our country infectious diseases are more prevalent and some infections produce same clinical and laboratory changes like Salmonella typhi and Brucella. Second reason is that like other underdeveloped countries in our country anemia is also common, also this type of study were not conducted in our province Jalalabad. Because of these reasons we tried to find hematological changes in brucella infected patients.

2. METHODOLOGY

2.1 Study Area, Study Design and Population

This is a prospective study which was conducted on a total of 45 Afghani patients from December 2018 up to December 2020 who admitted to the Nangarhar Regional Hospital and Safi private Hospital both located in eastern Afghanistan, Jalalabad city by the diagnosis of Brucellosis. The investigations were helded in laghman medical laboratory Jalalabad city. The patients were assessed according to the including and excluding criteria. The patient's age was in the range of 18 – 60years.

2.1.1 Inclusion criteria

1. Patients aged more than 18 years are included.
2. Patients had standard tube agglutination titer of 1:160 or more for Brucella antibodies were included.
3. Only (*B. mellitensis* or *B. abortus*) species of brucella are included

2.1.2 Exclusion criteria

1. Patients who had started antibiotic treatment before presenting to our hospital were excluded.
2. Patients that had other lymphoproliferative disorders were also excluded from this study.

The age range of patients were between 18 and 60 years. Both sexes were included. Patients

with complaints of fever, headache and other related symptoms of Brucellosis were investigated for Brucellosis. Hepatosplenomegaly was assessed by means of ultrasound. Diagnosis was confirmed by agglutination test for Brucellosis.

2.2 Data Collection

An informed consent was taken and a detailed clinical history was taken to rule out the confounding illnesses as outlined above and also ask about the symptoms of like fever, night sweats, headache, joint pain, muscle pain, etc. The most common nonspecific symptoms of brucellosis are fever, night sweats, asthenia, insomnia, anorexia and headache. Information of subjects recruited for the study was obtained by using a questionnaire which contains age, sex, socioeconomic status, education, living area, consumption of dairy products (cheese and raw milk etc) and animal contact history (cow, goat). Symptoms were also asked and added to the questionnaire. All patients were examined physically by the presence of enlarged lymph nodes. All patients were scanned by sinologist for findings of hepatomegaly or splenomegaly. Using 5 ml disposable syringe 4 ml of venous blood was drawn in from each patient for CBC, ESR and Rose Bengal test test of Brucellosis. Sample for CBC was collected in EDTA tube. Blood was centrifuged and Brucellosis test was done for all of them. ESR and CBC examinations all were done. Patients had standard tube agglutination titer of 1:80 or more for Brucella antibodies were considered positive for having Brucella (*B. mellitensis* or *B. abortus*). Other species were not included in our study. Collected data was then analyzed and results were obtained. Anaemia was diagnosed by Hb < 12 g/dl, while PLT count < 200 × 10⁹/l and WBC count < 4.0 × 10⁹/l were used to determine thrombocytopenia and leukopenia respectively. ESR >20mm/hr were considered elevated.

3. RESULTS

This was a descriptive study which was undergone by 45 subjects of diagnosed Brucellosis. The age of patients in case group were (28.74±15.22) years. All of them were evaluated by doing blood hematological tests (Hemoglobin, TLC, Platelet count, Brucellosis serologic tests). Demographic parameters, clinical data and laboratory Parameter details were noted and analyzed using Microsoft Excel program.

The results of them are as follows.

In our study more of the people were uneducated (56%), people living in rural areas (80%), people consuming unpasteurized dairy products (56%), a lot of people were from low economical category (46%) and upto 86.6% of them were female. We are concluded that 86% of the patients were female in the other words we can say that female was more affected by Brucellosis. Because they are more in contact with animals and also they are consuming unpasteurized dairy products because of lack of education, so they are more prone to brucellosis. Most Brucellosis cases were in low and middle socioeconomic families and most positive cases were patients residing in urban areas. In our study we see that uneducated peoples are more affected by undulant fever.

This Figure shows that the results of clinical signs and symptoms are as follows. Headache and fever were the most common presenting symptom in nearly all patients. Arthralgia and myalgia both were present in approximately half of patients. Night sweats were about 40%. Lymphadenopathy is another common finding of the disease which were present in about 46 % patients of Brucellosis.

This table shows that in Brucella positive patients the anemia was present at 57% patients. Leukopenia was present in large number of patients (40%) than leukocytosis which was present only in 13% of patients.

Thrombocytopenia was present at about 24% of patients. In 24% of the patients, pancytopenia was present it means that Brucella is also one cause of pancytopenia. ESR were significantly elevated in two third of patients that only 33% patients had normal ESR.

4. DISCUSSION

Human contact with infected domestic animals is often a transmission route of Brucellosis infection. It is a systemic infection which can present in a multitude of ways.

The Geographical range of infected individuals suggests that most cases were resident in urban areas. This is may be because of individuals living in rural areas are in close contact with animals and are at high risk. This study results are the same with a study done in Iran an which also more cases were in rural areas [19].

In the present study, positive cases were commonly seen in young adults, because of their contact with animals for animal breeding or husbandary, which agrees with the Wasfy et al study [19]. In our study group females are more affected than males but in other studies males are more affected the reason is thus in our country males are not concerning with animals but females are in direct contact with domestic animals. This could explain the possible reason of brucellosis cases are more commonly seen in afghani females than in males.

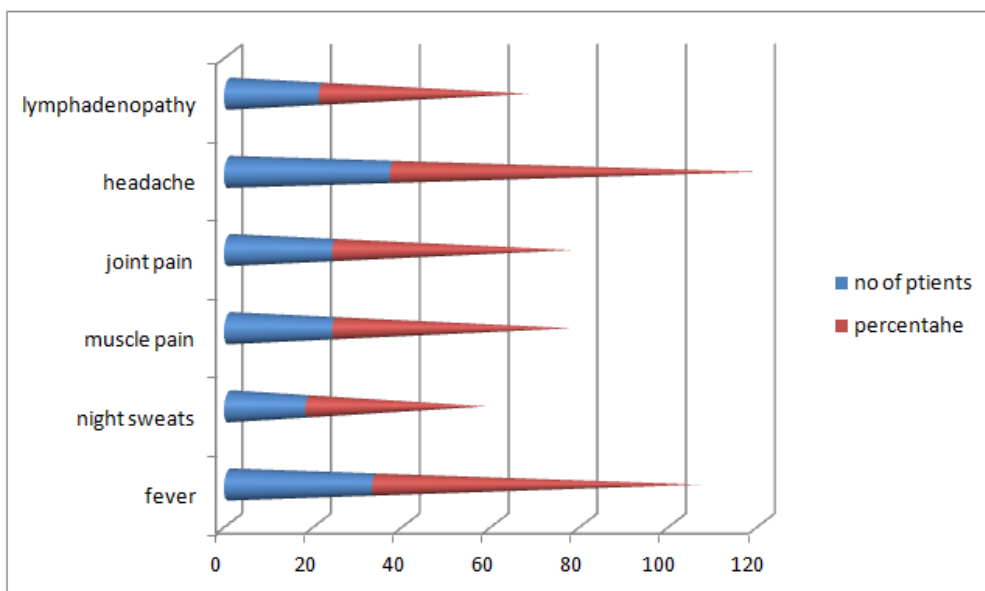


Fig. 1. Demonstration of clinical symptoms

Table 1. Comparison of the various hematological parameters of Brucellosis patients

Blood tests	No. of patients	Percentage (%)
Hemoglobin <12gm/dl	26	57.7
WBC count >11000 cells/mm ³	6	13.3
WBC count <4000cells/mm ³	18	40
Lymphopenia <1000 cells/mm ³	14	31.1
Lymphocytosis >4000 cells/mm ³	25	55.5
Thrombocytopenia <2 lac cells/mm ³	12	24
Pancytopenia	11	24.4
ESR <20mm/hr	15	33.3
ESR 20-5-mm/hr	24	53.3
ESR >50mm/hr	6	13.3

WBC= white blood count, ESR= Erythrocyte sedimentation rate

In patients with brucellosis the anaemia results mostly from bone marrow suppression, hypersplenism, autoimmune hemolysis or alteration of iron metabolism secondary to infection. Leukopenia has frequently been found in previous studies of patients with brucellosis and has been considered of diagnostic importance [20]. This abnormality has been reported to occur in 30-50% of patients in some studies [21]. We found leukopenia in 40% of our patients. Leukocytosis was less observed in our patients (13%). A normal or reduced leucocyte count with relative lymphocytosis is common in brucellosis. The possible mechanism for thrombocytopenia and pancytopenia have been suggested to include hypersplenism or bone marrow aplasia. As pancytopenia was observed in our study group also splenomegaly was present, this could explain that why pancytopenia occurs in brucellosis patients [21]. This study is the same. The ESR is normal or mildly elevated and it is of prognostic rather than diagnostic significance, when it is during the early stage of disease. This results of our study is relevant with the same study done by Ajlouni Y.M. & Shaker K in Jordan university [21].

5. CONCLUSION

From our study, we concluded that Brucellosis is more common in females than males. Brucellosis is also tend to infect peoples of having low economic state, consuming unpasteurized dairy products, living in urban areas and are uneducated. In conclusion hematological abnormalities are common in brucellosis. Brucellosis should be included in the differential diagnosis of patients presenting with anaemia, leucopenia and thrombocytopenia

6. LIMITATIONS

Because of incomplete resources and small sample size in our study may affect our research

accuracy. Also as our society has more uneducated people and are not ready to take part in research programs this is another fact to limit our study. As our country is very far from health facilities so we had no culture facilities for our research, which was also a limitation for our study.

7. RECOMMENDATIONS

We are recommending that another study is required to find association among brucella culture positive patients and hematological changes. All people living in brucella endemic area should be examined for brucellosis. Animals should be screened for brucellosis and if infected people should avoid them.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline Patient's consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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