

ASSESSMENT OF THE LABORATORY TRANSMISSION OF BRUCELLOSIS IN AN ENDEMIC REGION

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ABSTRACT

Objectives: Laboratory-acquired brucellosis (LB) has been one of the most commonly reported laboratory-associated bacterial infections in both endemic and non-endemic countries. Brucellosis is endemic in Turkey. The aim of this study is to describe the risk factors of LB among laboratory healthcare workers.

Material and method: A regional survey study was conducted by face-to-face interview in 7 hospitals from Diyarbakir, Mardin and Batman province, in southeaster Anatolia in Turkey. A structured survey questionnaire was administered to the Laboratory healthcare workers, employed in infectious diseases clinics and microbiology departments, who were at risk of Brucella infection.

Result: Of the 136 laboratory workers, 13 (9.5%) had a history of laboratory-acquired brucellosis. Logistic regression analysis identified factors independently associated with an increased risk of LB including lack of biosafety cabinet ($P<0.005$) and a lack of compliance in the use of the same ($P<0.005$). Using a biosafety cabinet ($P<0.005$), existence of biosafety cabinet ($P<0.005$), full adherence to glove use ($P<0.005$) and male gender ($P<0.005$) were found to be protective factors.

Conclusion: Increased adherence to personal protective equipment and use of biosafety cabinets should be priority targets to prevent LB.

Key words: Brucellosis, Laboratory Transmission.

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Introduction

Laboratory-acquired brucellosis (LB) is the most frequently reported laboratory-acquired infection both in endemic and non-endemic countries. Cases of LB have been reported since 1941⁽¹⁻⁵⁾. The risk for transmission is reported to be particularly high among the clinical microbiology laboratory personnel⁽¹⁻⁷⁾. Although the main route of transmission of brucellosis in the laboratory setting is inhalation, direct oral ingestion of the bacteria has also been observed^(1-4,8). Bacteriological procedures conducted using infected aerosols and samples containing live bacteria carry the greatest risk for transmission^(9,10). Although the ratio of the development of infection after exposure to infected material varies according to the route of transmission and the number of bacteria within the contaminated material, it has been reported as 30-100%^(11, 13). LB is an

important problem especially in the regions where the disease is endemic. The World Health Organisation (WHO) has classified species of brucellosis in risk group III, which indicates a high risk for those who are exposed. Although its incidence has been reported as 2%, epidemics of laboratory origin have also been reported⁽¹¹⁾. In a study conducted in our country, the incidence of LB has been found as 18% in the health professionals under risk and as 8% for the year of the study⁽¹²⁾. Our country is an endemic region for brucellosis. According to the data from the Ministry of Health, 18.563 cases have been reported in 2004 (incidence: 25.6/100.000). Thanks to the intense vaccination programs for livestock, isolation and elimination of the infected animals, control of the movements of the animals and public education, the number of the reported cases has shown a considerable decrease in the last years (10.224 cases in 2009; incidence:

13.5/100.000)⁽¹⁴⁾. Among high-risk patients in the eastern part of Turkey, seropositivity has been reported to be as high as 27.2%⁽¹⁵⁾. Since there are a number of potential sources for the transmission of the disease in a country like Turkey where the disease is endemic, especially in LB, it is not always easy to determine the route of transmission. The aim of the present study is to evaluate the risk factors for LB for health professionals especially in our region, where brucellosis is an endemic disease.

Material and method

The study was conducted between December 2012 and February 2013 as a regional study including three provinces (Mardin, Diyarbakir, Batman) in the southeast Anatolian region of Turkey. For the purposes of the study, a questionnaire was prepared. The study was conducted on the healthcare personnel of a university hospital, two training and research hospitals, two public and three private hospitals. Healthcare professionals working in the infectious diseases Departments and clinical microbiology clinic who are under risk for LB infection were included in the study. The participants' age, gender, profession, personal protective equipment (gloves, mask, gown, etc.) and biosafety cabinet use, and adherence to protective measures have been investigated. The diagnosis of brucellosis was made through the isolation of the brucellosis from the clinical samples or a Brucella tube agglutination titre of $\geq 1/160$. Patients' treatment results, complications, any relapses and long-term complaints were also recorded. In order to exclude other transmission routes of the disease, any contact with infected animals or tissues, family history and consumption of unpasteurised milk and dairy products were also investigated.

Everyone who had one of above reported factors was excluded from the study since they could not be classified as work-related infection. The group with LB constituted the patient group, while those who were free of brucellosis formed the control group. After the approval of the Dicle University Ethics Committee was obtained, patients with laboratory-acquired brucellosis were compared with the control group in terms of the risk factors. The patient group was also evaluated within itself through a multivariate analysis.

Statistical analysis

The calculations were performed using the

Statistical Package for Social Sciences software version 16.0 for Windows.

The Kolmogorov–Smirnov test was used to confirm that data were within the ranges of normal distribution in both groups. A nonparametric test was employed for the variables outside the normal distribution. The comparison of the data between reciprocal groups was carried out through the Mann–Whitney-U and Chi-square test. The

Chi-square test with the Yates correction or Fisher's exact test have been used for the comparison of nonparametric values. For the multivariate analyses the possible factors identified with univariate analyses were further entered into the logistic regression analyses to determined independent predictors of Laboratory transmission. Hosmer–Lemeshow goodness of fit statistics were used to assess model fit. A hierarchical stepwise method was used to construct the multiple regression models in relation to various dependent variables. Statistical significance was based on a value of $p < 0.05$ with a 95 % confidence interval.

Results

A total of 136 healthcare professionals under the risk of LB were included in the study. Among these, 20 had brucellosis. In the group of the patients who had brucellosis, 7 were excluded from the study due to a history of contact with infected animals or tissues, family history, or consumption of unpasteurised milk and dairy products. The control group consisted of 116 patients. The remaining 13 patients had laboratory-acquired brucellosis. The demographic characteristics of the patients are reported in Table 1.

When the route of transmission was investigated, the disease was found to have been acquired through inhalation by 4 patients (30%), of whom one was pregnant. A laboratory technician was infected through the oral route while using a pipette. The majority of the patients (69%) were infected before 2007. The most commonly observed symptoms were fatigue, profuse sweating, fever and joint pain. Arthritis was observed in 8 patients, while 7 patients had sacroiliitis. When the results of the univariate analysis were evaluated, only the use of the biosafety cabinet was statistically significantly higher in the control group in comparison to the LB group ($p=0.048$). Among the patients with LB, only three were male. The multivariate analysis pointed out the female gender as a risk factor ($p=0.012$); while the

use of the biosafety cabinet ($P=0.011$), presence of the biosafety cabinet ($p=0.002$) and full adherence to glove use ($p=0.008$) were found as protective factors (Table 2).

	LB group N=13 (%)	Control group N=116 (%)	<i>P</i>
Profession			
Physician	3 (23)	22 (18)	0.710
Laboratory technician	6 (46)	38 (33)	0.377
Mean age	37.69±7.18	33.09±8.11	0.520
Full adherence to personal protective equipments			
Gloves	11 (85)	93 (80)	0.758
Gown	10 (77)	80 (69)	0.526
Mask	5 (38) 63	(54)	0.223
Goggles	3 (23)	33 (28)	0.401
Use of biosafety level 2	1 (7)	16 (14)	0.048

Table 1: Univariate analysis for the predictors of laboratory-acquired brucellosis cases.

	Odds ratio	<i>p</i>
Use of biosafety cabinet level II	57.608	0.011
Full adherence to glove use	6.527	0.008
Presence of biosafety cabinet	0.038	0.002
Female gender	0.272	0.012

Table 2: Multivariate analysis for the predictors of laboratory-acquired brucellosis.

Discussion

Brucellosis is a professional disease for farmers, slaughterhouse employees, veterinarians, doctors and laboratory personnel^(16,17). LB is a serious problem especially in developing countries where the disease is endemic and the biosafety measures are not properly applied in the laboratory⁽⁶⁾. In a multi-centre study conducted by Sayın-Kutlu et al. in various regions in Turkey in recent years, LB was detected in 5.8% among 667 health-care professionals⁽¹⁸⁾. In another study conducted in Spain, Bauza et al. have found that brucellosis is an endemic infection observed more frequently among

laboratory personnel compared to the general population and reported the ratio of laboratory-acquired brucellosis in Spain as 11.9%⁽⁶⁾.

In our study, this ratio was found as 9.5%. The higher ratio observed in our study in comparison to the study by Sayın-Kutlu et al. was associated with the fact that our region is an endemic region where brucellosis is observed more frequently. In spite of all these data, it is difficult to determine the prevalence of the laboratory transmission of brucellosis due to the inefficiency of the systemic reporting⁽¹⁸⁾. As the number of the clinical studies conducted with live *Brucella* bacteria at the laboratory has increased, the number of the LB cases has shown a parallel increase since the year 2000. The reason for the increase in the number of the cases of LB in Turkey is the increase in the number of the articles focussing on LB after the year 2000. The widespread use of biosafety cabinets especially after 2007 has led to a decrease in the number of the cases. Also in our study, the majority of the cases (69%) had contracted the disease before 2007⁽¹⁸⁾.

Other reasons for the decrease in the number of the cases may be the increased awareness due to the more frequent articles on LB and the greater number of the scientific presentations on LB since the year 2000^(12, 19, 20). In our study, the routes of transmission were inhalation in 4 patients and oral ingestion in one patient though a pipette. In the remaining cases of LB, the route of transmission could not be specified. When the LB group was compared to the control group in our study, no difference has been observed in terms of the mean age or adherence to personal protective equipment (gown, gloves, goggles and mask, etc.), though the use of biosafety cabinet was the only factor significantly higher in the control group. In a study conducted in our country⁽¹⁸⁾, half of the patients with LB were physicians, while in our study half of the patients who had contracted brucellosis were laboratory technicians, since the hospitals that participated in our study were mainly second-line hospitals where the majority of the laboratory personnel were technicians. The multivariate analysis of the LB group pointed out the use of the biosafety cabinet, the presence of biosafety cabinet and the use of gloves as protective factors.

On the other hand, female gender was found as a risk factor. The above-mentioned study⁽¹⁸⁾ had also pointed out the use of biosafety cabinet and gloves as protective factors, while male gender was found to be a risk factor. Since the majority of the

patients in our study were female, the female gender stood out as a risk factor in our study. In the study by Tekin et al. including also our region, the most frequently observed symptoms in the patients with brucellosis were fatigue, fever, muscle and joint pain and night sweats. The most frequently observed clinical findings were sacroiliitis and arthritis⁽²¹⁾. In our patients, the most frequently observed symptoms were fatigue, profuse sweating, fever and joint pain, while sacroiliitis and arthritis were the prominent findings in the physical examination. Thus, our results were compatible with the results of the previous regional study.

In conclusion, there have been rapid improvements in the health sector in our country, which were also reflected to the laboratory conditions. However, LB transmission is still occurring due to the failure to adhere to the use of the personal protective equipment (gown, gloves, goggles and mask, etc.) and the biosafety cabinet though it is present at the laboratory. Therefore, health professionals should be educated on the routes of transmission of LB, the related risk factors and the protective measures including especially the use of the biosafety cabinet.

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