

## Original Article

# Expression of eosinophils be beneficial to early clinical diagnosis of brucellosis

Peng-Fei Jiao, Wei-Li Chu, Gao-Fei Ren, Jun-Na Hou, Ya-Meng Li, Li-Hua Xing

Department of Respiration and Intensive, The First Affiliated Hospital of Zhengzhou University, Zhengzhou 450052, Henan Province, China

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**Abstract:** Objective: Investigate the expression and significance of eosinophils in brucellosis. Methods: retrospective analysis of clinical data for 151 brucellosis patients (BR group), complete blood count and blood bacterial culture etc.; in addition, 150 general bacterial infection patients (BI group) and 135 persons in healthy physical condition upon testing (NC group) are selected respectively as the control groups to comparatively study expression of white blood cells and eosinophils for brucellosis patients. Adopt t test to compare measurement data. Results: in comparison with BI group, WBC, NE, EO, MO, NE% and EO% in BR group are reduced but LY, LY% and MO% are increased and such difference shows statistical significance ( $P<0.01$ ). In comparison with NC group, difference of WBC and NE in BR group shows no statistical significance ( $P>0.05$ ). NE%, EO and EO% are reduced but MO, LY% and MO% are increased and such difference shows statistical significance ( $P<0.01$ ). LY is increased and the difference shows statistical significance ( $P<0.05$ ). White blood cell count is normal or is reduced among most of Brucellosis patients, accounting for 90.73% (137/151); the patients whose eosinophils are reduced account for 75.50% (114/151) and those whose eosinophils disappear are about 18.54% (28/151). Conclusion: There is an incidence rate of eosinophils decrease or disappearance in Brucellosis and it shows the indication significance in the diagnosis of early disease.

**Keywords:** Brucellosis, eosinophils, retrospective study

## Introduction

Brucellosis is an infectious disease induced by *Brucella* and it can be infected between human being and animals. It is mainly popular in Inner Mongolia Autonomous Region, Jilin Province, Heilongjiang Province and Xinjiang Uygur Autonomous Region in China [1, 2] and it is infected to human being through skin and mucosa, digestive tract and respiratory tract of sheep, cattle and other livestock. As the clinical manifestations of the disease are not typical and the contact history is relatively hidden and sporadic cases are found in other areas in China, it is difficult to diagnose in clinical [3]. In this study, the clinical data of 151 eosinophils patients, who visited the respiratory department of the hospital from September 2012 to September 2014, is retrospectively studied to investigate the value of eosinophils decrease in the diagnosis of Brucellosis disease.

## Data and methods

### Patient data

Among 151 eosinophils patients (BR group), who visited the respiratory department of the hospital from September 2012 to September 2014, there are 103 male and 48 female and their age is 16-83 years old and their average age is  $45.3\pm 15.4$ . Eosinophils is diagnosed in accordance with Eosinophils Diagnosis Standard issued by Department of Local Disease Prevention and Control, the Ministry of Health in China [2]. 150 patients (BI group, excluding typhoid fever, brucellosis), who suffer from the general bacterial infection and visit the hospital in the same period, are selected, among them, there are 110 male and 40 female and their age is 15-80 years old and their average age is  $43.7\pm 17.8$ . Additionally, 135 healthy persons (NC group), who come to the hospital for the

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**Table 1.** Comparison of differential blood count among Brucellosis patients, general bacterial infection patients and normal control persons ( $\bar{x} \pm s$ )

Group	Patients (Male/Female)	Age	WBC $\times 10^9/L$	NE $\times 10^9/L$	EO $\times 10^9/L$	LY $\times 10^9/L$	MO $\times 10^9/L$
BR	151 (103/48)	45.34 $\pm$ 15.35	5.92 $\pm$ 2.67 <sup>a</sup>	3.14 $\pm$ 1.97 <sup>a</sup>	0.03 $\pm$ 0.06 <sup>a,c</sup>	2.03 $\pm$ 1.16 <sup>a,b</sup>	0.58 $\pm$ 0.58 <sup>a,c</sup>
BI	150 (110/40)	43.70 $\pm$ 17.82	12.02 $\pm$ 4.08	9.28 $\pm$ 3.91	0.22 $\pm$ 0.71	1.65 $\pm$ 0.85	0.91 $\pm$ 0.77
NC	135 (101/34)	44.62 $\pm$ 18.41	5.62 $\pm$ 1.44	3.33 $\pm$ 1.10	0.18 $\pm$ 0.15	1.79 $\pm$ 0.47	0.31 $\pm$ 0.13
Group	Patients (Male/Female)	NE% %	EO% %	LY% %	MO% %		
BR	151 (103/48)	52.81 $\pm$ 13.18 <sup>a,c</sup>	0.55 $\pm$ 0.87 <sup>a,c</sup>	36.72 $\pm$ 12.84 <sup>a,c</sup>	10.22 $\pm$ 8.08 <sup>a,c</sup>		
BI	150 (110/40)	75.36 $\pm$ 11.88	1.60 $\pm$ 1.84	15.34 $\pm$ 9.24	7.57 $\pm$ 4.20		
NC	135 (101/34)	58.73 $\pm$ 7.50	3.22 $\pm$ 1.10	32.46 $\pm$ 6.68	5.38 $\pm$ 1.48		

Note: BR: Brucellosis group; BI: general bacterial infection group; NC: normal control group; comparing with BI group vs bacterial infection group, <sup>a</sup> $P < 0.01$ ; comparing with NC group vs. normal control group, <sup>b</sup> $P < 0.05$ , <sup>c</sup> $P < 0.01$ .

body examination in the same period, are selected, among them, there are 101 male and 34 female and their age is 17-78 years old and their average age is 44.6 $\pm$ 18.4. The difference among the three groups of persons shows no statistical significance.

### Study methods

Three groups of persons are drawn the blood under the condition of empty stomach so as to test their complete blood count, determine white blood cell (WBC), neutrophil cell count (NE) and its ratio (NE%), eosinophils count (EO) and its ratio (EO%), lymphocyte count (LY) and its ratio (LY%), monocyte count (MO) and its ratio (MO%). Ask the detailed disease history of the patients in BR group when they are admitted to the hospital and draw their blood for Brucella standard agglutination tube test (SAT) and blood bacterial culture.

Complete blood cell count and classification are tested by Beckman Coulter LH750 (USA) automatic blood analyzer and the imported reagent; blood bacterial culture is tested by BacT/ALERT 3D (BioMerieux, France) automatic blood culture instrument and the imported reagent; SAT blood is sent to CDC of Henan Province for chemical examination.

### Statistical analysis

SPSS19.0 software is used for statistical analysis. Measurement data is tested by *t* and expressed by ( $\bar{x} \pm s$ ).  $P < 0.05$  indicates that the difference has the statistical significance.

### Result

#### General clinical data of brucellosis

patients 103 male (68.2%), 48 female (31.8%), age (16~83), average age (45.34 $\pm$ 15.35), dis-

ease course: (1~300) days; average: 40 (3, 150) days; body temperature heat peak: 37.5~42°C, 8 patients' body temperature is 37.5~38°C (Accounting for 5.3%), 36 patients' body temperature 38~39°C (Accounting for 23.8%), 76 patients' body temperature 39~40°C (Accounting for 50.3%), 31 patients' body temperature >40°C (Accounting for 20.5%); 79 patients have the clear contact history (52.3%) and 72 patients have no clear contact history (47.7%); 136 patients present positive SAT, accounting for 90.1% and 123 patients present positive blood culture, accounting for 81.5%. 108 patients present positive SAT and blood culture, accounting for 71.5%.

#### Results of the complete blood count in the three groups of persons

*Comparing the differential blood count in the three groups of persons:* In comparison with BI group, WBC, NE, EO, MO, NE% and EO% in BR group are reduced, such difference shows statistical significance ( $P < 0.01$ ) but LY, LY% and MO% are increased. The difference shows statistical significance ( $P < 0.01$ ). In comparison with NC group, difference of WBC and NE in BR group shows no statistical significance ( $P > 0.05$ ). NE%, EO and EO% are reduced and such difference shows statistical significance ( $P < 0.01$ ) but LY is increased. The difference shows statistical significance ( $P < 0.05$ ). MO, LY% and MO% are increased and the difference shows statistical significance ( $P < 0.01$ ). See **Table 1.**

*Blood cell classification features of brucellosis patients:* White cell count of brucellosis patients is normal or decreased. White cell is only increased by 9.27%; brucellosis patients, whose eosinophils percentage is decreased, account for 75.50%; the patients, whose eosin-

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**Table 2.** Blood cell classification features of brucellosis patients

	WBC ( $\times 10^9/L$ )			EO (%)					
	<4	4~10	>10	0	0~0.5	0.5~5	>5		
Patients	35	102	14	28	86	35	2		
Percentage	23.18%	67.55%	9.27%	18.54%	56.95%	23.18%	1.32%		
	NE (%)			LY (%)			MO (%)		
	<50	50~75	>75	<20	20~40	>40	<3	3~8	>8
Patients	59	85	7	12	81	58	4	112	35
Percentage	39.07%	56.29%	4.64%	7.95%	53.64%	38.41%	2.65%	74.17%	23.18%

Note: WBC: white blood cell count; EO (%): eosinophils percentage; NE (%): neutrophils percentage; LY (%): lymphocyte percentage; MO (%): monocyte percentage.

ophils disappear, account for 18.54%; the patients, whose eosinophils increase, only account for 1.32%; the patients, whose neutrophils percentage is normal or decreased, account for 95.36%; the patients, whose lymphocyte percentage is normal or increased, account for 38.41%; the patients, whose monocyte percentage is normal, account for 74.17%; See **Table 2**.

### Discussion

Brucellosis is an infectious disease that can be infected between human being and animals and that is popular in pastoral areas. However, in recent years, more sporadic brucellosis has been reported in non-endemic areas. The incidence trend is changed from multiple and sporadic state to the large-scale outbreak [4, 5]. 151 patients were admitted to the respiratory department of the hospital from 2012 to 2014 and they were diagnosed with brucellosis, among which 79 patients had the clear cattle and sheep contact history and 72 patients had no clear contact history. Sporadic patients are increased, which may be related to the barbecue in night market in recent years, especially the roast lamb. They don't know they eat lamb that is uncooked enough, thus it increases the difficulty of clinical diagnosis.

The brucellosis person is prone to susceptibility and the prevalence of male is higher than female. The male patients are 103 and accounting for 68.2% in this study, which is coincidence with the previous literature report [6]. It may be related to the occupation and eating habits of male. Brucellosis may invade all systems of the human body and its clinical manifestations are complex and diverse, such as high body temperature, ache and painful muscle and large

joint but the lack of specificity. 151 patients in this study have a fever to different extent and most of them have high body temperature. Among them, heat peak of 107 patients is higher than 39°C (70.9%). Their average disease course is 40 (3, 150) days, which demonstrates hate the clinical diagnosis is difficult. It is usually reported that the untypical Brucellosis is misdiagnosed as blood system disease or rheumatic disease [7-9].

The diagnosis of Brucellosis is dependent on SAT positive or brucellosis separated from blood, bone marrow and other tissue fluid bacterial culture. 151 patients in the study are diagnosed in reliance on SAT and blood bacterial culture. The positive rate of two indexes is higher (SAT positive rate is 90.1%; blood bacterial culture positive rate is 81.5%). Two indexes are supplemented with each other in the clinical diagnosis. The disease often involves the blood system and the majority of the damage is mild [10, 11], but in some cases, the complete blood cells decrease and bone marrow changes [12, 13].

In this study, compared with the general bacterial infection patients, white blood cells, neutrophils and eosinophils of the Brucellosis patients are decreased significantly, but their lymphocyte is increased remarkably. In comparison with the normal control group, decrease of eosinophils and increase of lymphocyte percentage show the same statistical difference. It indicates that the blood of brucellosis patient changes, at the same time, it is different from the general bacterial infection. After making a further analysis of blood cell classification for 151 brucellosis patients, the patients, whose white blood cells are normal or decreased, account for 90.73% (the patients with normal

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white blood cells are 67.55% and the patients with the decreased white blood cells are 23.18%); the patients, whose neutrophil proportion is normal or decreased, account for 95.36% (the patients with normal neutrophil proportion are 56.29% and the patients with the decreased neutrophil proportion are 39.07%); The patients, whose lymphocyte percentage is increased, account for 38.41%; it is coincidence with the general views [14, 15]. At the same time, we find that the eosinophils proportion and count of brucellosis patients are diseased significantly and there are 28 patients whose eosinophils disappears (18.54%) and 86 patients whose eosinophils is decreased (56.95%). This phenomenon is rarely reported in home and abroad and the specific reasons are unknown. Eosinophils are decreased in typhoid fever, paratyphoid fever, severe tissue injury after surgery and upon application of adrenal cortical hormone or promotion adrenal gland hormone. Brucellosis antigen shares some common components with the antigen of typhoid fever and paratyphoid fever [16]. Thus we assume that Brucellosis may have parenteric fever reaction. After the human body is infected with Brucellosis, endotoxin released from the bacterial death or cracking is an important pathogenesis material. Whether change of eosinophils is related to endotoxin, which is required to be further studied and proven. Because of the time limitation of SAT and bacterial culture test, it is more quickly to test the complete blood count and the diagnosis direction can be indicated in time in case of eosinophils cell decrease or disappearance. When typhoid fever is taken into consideration, it shall prevent brucellosis from being missed in diagnosis.

In summary, there is an incidence rate of eosinophils decrease or disappearance in Brucellosis and it shows the indication significance in the diagnosis of early disease. There are still defects in this study. The study is a retrospective analysis and lack of the dynamic change to eosinophils cell count at different stages of Brucellosis and its dynamic relationship shall be further studied.

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### Disclosure of conflict of interest

None.

**Address correspondence to:** Dr. Peng-Fei Jiao, Critical Section, The First Affiliated Hospital of Zhengzhou University, Jianshe Road No. 2001, Zhengzhou 450052, Henan Province, China. Tel: +86-15890688459; E-mail: lhxingzzu@126.com

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