Journal of Animal and Veterinary Advances 9 (14): 1905-1908, 2010
ISSN: 1680-5593

Human Infection with Hemoplasma in Mainland China

Q.J. Zhuang, H.Q. Song, X.Q. Zhu and B.Q. Fu
Key Laboratory of Veterinary Parasitology of Gansu Province,
Key Laboratory of Zoonoses of Agriculture Ministry,
State Key Laboratory of Veterinary Etiological Biology,
Lanzhou Veterinary Research Institute, CAAS, Lanzhou, Gansu Province 730046,
The people's of Republic China

Abstract: Human infection with hemoplasma has been extensively reported in China. The present study reviews prevalence and outbreaks of human hemoplasma in China. This type of disease may really exist in humans but it may be over-reported because of etiological mis-recognition and/or inadequate diagnostic tests in China. Molecular studies to re-assess the prevalence of human hemoplasma are warranted.

Key words: *Eperythrozoon*, *Hemobartonella*, hemoplasma, outbreak, extensively, China

INTRODUCTION

Hemoplasmas are a group of bacteria that infect animals and animals. They are small epicellular parasites that adhere to the host's erythrocytes which were originally classified as members of the two genera of order *Rickettsiales* namely *Eperythrozoon* and *Haemobartonella*.

There once have been sporadic reports of similar infections in man but these have been poorly characterized (Pitcher and Nicholas, 2005; Hoelzle, 2008). A recent study showed *Mycoplasma haemofelis* like infection in an HIV-positive patient which is the first molecular study to date documenting hemoplasmas infection in human beings (Santos *et al*., 2008). However, outbreaks of human infection with hemoplasma have been extensively reported in China, this type of disease was called human eperythroonsis in China.

PREVALENCE OF HUMAN HEMOPLASMA (HUMAN EPERYTHROONSIS) IN CHINA

In China, human infection with *Eperythrozoon* has been deemed as galactic hazardous to public health and extensive studies have been attempted to assess the prevalence of hemoplasma in selected human populations (Yang *et al*., 2007; Ma *et al*., 2005). Since 1991, this disease has been seen sporadically in Inner Mongolia, China (Yang *et al*., 2007). The number of cases has increased sharply in recently years. Table 1 shows epidemiological surveys of human hemoplasma carried out between 1992-2009 with 0-100% prevalence and an average of 44.8% (19,691/43,929) people in China were positive.

VISUAL IDENTIFICATION AS THE ONLY CRITERIA FOR HUMAN HEMOPLASMA

However, the lack of an adequate diagnostic test for *Eperythrozoon* hampers the identification of infected human. Although visual identification of hemoplasmas is a subjective way to detect those organisms (Messick, 2004), this approach has been widely used in China. Such diagnostic problem is likely to lead to over-reporting of the prevalence of human hemoplasma in China. At present, reported outbreaks of human eperythroonsis in China used only visual identification as criteria for diagnosis but no molecular studies to assess the prevalence have been reported.

UNDEFINED CATEGORIZATION OF HUMAN INFECTION WITH HEMOPLASMA

Hemoplasmas are organisms that are obligated to attach to red blood cells of several mammalian species as well as human (Messick, 2004; Pitcher and Nicholas, 2005; Hoelzle, 2008). But a widely cited case report in China showed that suspected *Eperythrozoon* was able to exist in swollen lymph node of the neck from a patient (Puntaric *et al*., 1986).

Additional studies have documented that bone marrow are the main location of generation of *Eperythrozoon* in human body (Tai *et al*., 1998a) and

Corresponding Author: B.Q. Fu, Lanzhou Veterinary Research Institute, CAAS, 1 Xujiaping, Yanchangbao, Chenguan District, Lanzhou, Gansu Province 730046, The People's of Republic China

Table 1: Reported outbreaks of human hemoplasma, according to a range of national and provincial surveys in mainland China carried out between 1992-2009

Years report	Location city, country, Province)	Number examined	Number infected	Prevalence (%)	References
1992	Inner Mongolia	79	69	87.34	Shi ZB *et al.* (1992)
1994	Inner Mongolia	473	412	87.00	Du YF (1994)
1994	Inner Mongolia	105	90	85.00	Hou JF *et al.* (1994)
1995	Linshou, Hebei	268	0	0.00	Shang DQ *et al.* (1995)
1995	Inner Mongolia	100	80	80.00	Le FY *et al.* (1995)
1995	Nantong, Jiangsu	82	0	0.00	Shang DQ *et al.* (1995)
1995	Gaoning, Jiangsu	396	315	79.50	Shang DQ *et al.* (1995)
1995	Qing Tongxia, Ningxia	96	16	16.70	Shang DQ *et al.* (1995)
1996	Linshou, Hebei	707	0	0.00	Shang DQ *et al.* (1996)
1996	Gaoning, Jiangsu	944	790	83.69	Shang DQ *et al.* (1996)
1996	Xifeng, Liaoning	105	0	0.00	Shang DQ *et al.* (1996)
1996	Fushun, Liaoning	19	0	0.00	Shang DQ *et al.* (1996)
1997	Lanzhou, Gansu	277	205	70.40	Tian H *et al.* (1997)
1997	Lanzhou, Gansu	98	98	100.00	Li QJ *et al.* (1997)
1997	Nanhai, Guangdong	219	113	51.60	Shang DQ *et al.* (1997)
1997	Ningshan, Guangxi	376	197	52.30	Shang DQ *et al.* (1997)
1997	Nanning, Guangxi	68	35	51.40	Shang DQ *et al.* (1997)
1997	Inner Mongolia	1529	540	35.32	Yun X *et al.* (1997)
1997	Gaoning, Jiangsu	463	378	81.60	Shang DQ *et al.* (1997)
1997	Liaoning	702	0	0.00	Sun GM *et al.* (1997)
1997	Xingjiang	200	90	45.00	Shang DQ *et al.* (1997)
1998	Inner Mongolia	1529	650	35.32	Tai XZ *et al.* (1998b)
1998	Xingjiang	200	90	45.00	Li L *et al.* (1998)
1998	Yunnan	700	513	73.29	Huang ZM *et al.* (1998)
1999	Fuyang, Anhui	1301	442	33.97	Yang YZ *et al.* (1999)
1999	Fuyang, Anhui	539	173	32.10	Yang and Sun (1999)
1995	Saxian, Fujian	517	218	42.17	Yan WY *et al.* (1995)
1999	Yuxi, Yunnan	4652	3470	74.59	Huang ZM *et al.* (1999)
2000	Fuyang, Anhui	624	235	37.66	Guo *et al.* (2000)
2000	Xuzhou, Jiangsu	400	55	7.50	Yang XC *et al.* (2000)
2000	Inner Mangolia	1529	540	35.30	Yang DX *et al.* (2000)
2000	Huaibei, Anhui	1115	397	35.60	Li ZY *et al.* (2000)
2000	Saxian, Fujian	986	485	49.19	Dong *et al.* (2000)
2000	Yuxi, Yunnan	1149	784	68.23	Huang (2000)
2001	Fuyang, Anhui	820	272	33.17	Li ZY *et al.* (2001)
2001	Ningxia	96	16	16.70	Zhang RY *et al.* (2001)
2001	Shandong	776	57	7.30	Tao XR *et al.* (2001)
2002	Yingchuan, Ningxia	300	123	41.00	Zhang MJ *et al.* (2002)
2003	Xingshan, Hubei	174	17	6.44	Zhou CX *et al.* (2003)
2003	Dalian, Liaoning	1051	982	93.00	Chen *et al.* (2003)
2006	Fuyang, Anhui	1301	442	33.97	Li GL *et al.* (2006)
2007	Xingshan, Hubei	5224	2931	56.11	Zhou CX *et al.* (2007)
2007	Tibet	3214	103	3.12	Shi GQ *et al.* (2007)
2007	Inner, Mangolia	1450	1421	98.00	Du YF *et al.* (2007)
2007	Gongshan, Yunnan	1408	960	68.18	He TC *et al.* (2007)
2008	Shanghai, Shanghai	997	129	12.94	Zhu M *et al.* (2008a)
2008	Shanghai, Shanghai	3003	516	17.18	Zhu M *et al.* (2008b)
2009	Taian, Shangdong	987	223	22.59	Han *et al.* (2009)
	Total	43348	19672	45.38	

bone marrow samples were also collected to assess the prevalence (Yang *et al*., 2000). Actually, molecular studies should be carried out to clarify whether hemoplasma do exist in bone marrow or other organs and tissues in human body.

UNDEFINED TRANSMISSION MODES FOR THE HUMAN INFECTION WITH HEMOPLASMA

Many studies in China attempted to explain modes of transmission for hemoplasma but the exact modes of transmission are still unknown. Close contact with infected individuals or insect bites, particularly by lice, fleas, mosquitoes, midges and stable flies are thought to be the principal modes of transmission between animals from animals to humans or transplacental transmission (Yang *et al*., 2000).

However, hemoplasmas appear to show the same host specificity as other mycoplasmas as judged by their identification through 16S rRNA sequencing (Pitcher and Nicholas, 2005; Yang *et al*., 2007). More strict animal experiments and molecular studies should be conducted to explain the mechanism of cross-species transmission. A recent report claimed that *Mycoplasma*

haemofelis DNA has been detected in HIV-positive patient, indicating that feline hemoplasma *M. haemofelis* may be a zoonotic causative organism that can infect human beings (Puntaric *et al*., 1986).

CONCLUSION

Hemoplasma may really existed in humans in China but it may be over-reported because of etiological mis-recognition and/or inadequate diagnostic tests in China. Genomic sequencing of human hemoplasma is essential for future studies including reclassification of this organism, identification of virulence factors, protein antigens, etc. Molecular studies to re-assess the prevalence of human hemoplasma are warranted.

REFERENCES

Chen, F.Y., F. Zhang and W. Rao, 2003. Investigation of *Eperythrozoon* infection in workers of Dalian City. Chin. J. Zoonoses, 19: 100-101.

Dong, C.Z., W.Y. Yan, C.C. Liu, X.J. Wei and R.Q. Hang, 2000. Investigation of *Eperythrozoon* infection in people of Saxian. Chin. J. Prev. Med., 34: 158-158.

Du, Y.F., 1994. Discovery of humans infected with *Eperythrozoon* in Aa La San District of Inner Mongolia. Chin. Med. J., 74: 86-86.

Du, Y.F., D. Ba, Y. Tian, J.Z. Peng and W.B. Zhang *et al*., 2007. Investigation of human infection with *Eperythrozoon* in Aa La San District of Inner Mongolia. Chin. J. Vet. Parasitol., 15: 31-33.

Guo, L., Y.Z. Yang, Z.Y. Li and G.L. Li, 2000. Investigation of *Eperythrozoon* infection in humans in Fuyang city. Lit. Inform. Prev. Med., 6: 51-51.

Han, Z.Q., X.H. Zhao, A.L. Yu, D. Li and X.M. Li, 2009. Investigation of *Eperythrozoon* infection in people in Taian city. Chin. J. Zoonoses, 25: 93-94.

He, T.C., Y.S. Feng, Y.L. Li, J. Zhao and Y.X. Cheng, 2007. Investigation of *Eperythrozoon* infection in Gongshan Country, Yunan Province. Pract. Prev. Med., 14: 382-383.

Hoelzle, L.E., 2008. Haemotrophic mycoplasmas: Recent advances in *Mycoplasma suis*. Vet. Microbiol., 130: 215-226.

Hou, J.F., B.Z. Chen, M.R. Yan, Y.F. Du and F.R. Zhang, 1994. Investigation of human infection with *Eperythrozoon*. Chin. J. Zoonoses, 10: 51-52.

Huang, Z.M., 2000. Investigation of *Eperythrozoon* infection in workers of Yuxi City. Control Med. Anim., 16: 534-535.

Huang, Z.M., X.W. Ma, J.M. Huang, W. Zhao, J.Y. Gong and K.W. Wang, 1999. Investigation of *Eperythrozoon* infection in Yuxi City, Yunnan Province. Chin. Pub. Health, 15: 31-31.

Huang, Z.M., X.Y. Ma, B. Fan and W. Zhao, 1998. Discovery of human infected with *Eperythrozoon* in Yunan Province. Chin. J. Zoonoses, 14: 35-36.

Le, F.Y., J.W. Zhao, C.L. Lv, N. Ni and L.P. Wang, 1995. Analysis of infection with eperythrozoonosis in 100 blood donors. Chin. J. Haematol., 16: 254-255.

Li, G.L., Y.Z. Yang, L. Guo and Z.Y. Li, 2006. Investigation of *Eperythrozoon* infection in Fuyang city. Dis. Surveillance, 21: 127-129.

Li, L., X.T. Di-Li, J.H. Wen, X.L. Han and J.T. Mai, 1998. An epidemiological investigation of *Eperythrozoon* infection in humans and animals in Xingjiang. Xingjiang J. Anim. Sci., 4: 44-45.

Li, Q.J., H. Tian, X.F. Liu, C.X. Sun and W.H. Yang *et al*., 1997. Investigation of *Eperythrozoon* infection in humans and mother-to-baby's vertical transmission. Chin. Pub. Health, 13: 714-714.

Li, Z.Y., C.Z. Sun, Y.Z. Yang, L. Guo, G.L. Li and S. Yang, 2000. Investigation of *Eperythrozoon* infection in people of Huaibei area. Henan Prev. Med., 11: 200-201.

Li, Z.Y., Z.H. Wang, Y.Z. Yang, L. Guo, G.L. Li and X.Q. Liu, 2001. Investigation of *Eperythrozoon* infection in p eople of Fuyang. Chin. Pub. Health, 17: 64-64.

Ma, X.B., L.Y. Wang and M.X. Wei, 2005. Advances of eperythrozoonsis in China. Sh. J. Prev. Med., 17: 516-519 (in Chinese).

Messick, J.B., 2004. *Hemotrophic mycoplasmas* (Hemoplasmas): A review and new insights into pathogenic potential. Vet. Clin. Pathol., 33: 2-13.

Pitcher, D.G. and R.A. Nicholas, 2005. Mycoplasma host specificity: Fect or fiction. Vet. J., 170: 300-306.

Puntaric, V., D. Borcic, D. Vukelic, T. Jeren, V. Burek, B. Richer and T. Wikerhauser, 1986. Eperythrozoonosis in man. Lancet., 2: 268-269.

Santos, A.P., R.P. dos Santos, A.W. Biondo, J.M. Dora and L.Z. Goldani*et al*, 2008. Hemoplasma infection in HIV-positive patient. Brazil. Emerg. Infect. Dis., 14: 1922-1924.

Shang, D.Q, Y.L. Li and J.H. Luan, 1995. An epidemiological investigation of *Eperythrozoon* infection in humans and animals (I). Chin. J. Epidemiol., 16: 143-146.

Shang, D.Q., L.Y. Li and B. Pei, 1996. An epidemiological investigation of *Eperythrozoon* infection in human and animals (II). Chin. J. Epidemiol., 17: 221-224.

Shang, D.Q., L.Y. Li and Z.G. Lu, 1997. An epidemiological investigation of *Eperythrozoon* infection in humans and animals (III). Chin. J. Epidemiol., 18: 150-152.

Shi, Q.G., S.Z. Li, G. Yang, H.Z. Chen, Y.Z. Lu, B.H. Qi and Y. Hong, 2007. Infection and prevention of human *Eperythrozoon* in plateau areas. Tibet Med. J., 28: 3-6.

Shi, Z.B., B.P. Li, X.Z. Tai, Q.R. Gao and J.R. Le, 1992. Prevalence of *Eperythrozoon* in primary school pupils. J. Inner Mongolia Med. Coll., 14: 146-146.

Sun, G.M., G.L. Tang, Z.C. Wang, C.Z. Wang and S.D. Dong, 1997. An epidemiological investigation of *Eperythrozoon* infection in humans in Liaoning Province. J. Chin. Pub. Health, 16: 159-159.

Tai, X.Z., D.X. Yang and L.J. Qin, 1998a. Morphologic features of human *Eperythrozoon*. Chin. J. Zoonoses., 14: 83-84, (In Chinese).

Tai, X.Z., D.X. Yang, L.J. Qin, H.P. Yang, L.P. Jing, G.L. Qi and X. Yun, 1998b. Investigation of *Eperythrozoon* infection in Inner Mongolia. Chin. J. Zoonoses, 14: 90-91.

Tao, X.R., X.J. Wang, T. Su, S. Cui and D.M. Zheng *et al*., 2001. Investigation of *Eperythrozoon* infection in people of Shandong Province. Chin. J. Epidemiol., 22: 359-361.

Tian, H., X.F. Liu, C.X. Sun, Q.J. LI and W.H. Yang *et al*., 1997. Investigation of *Eperythrozoon* infection in humans and vertical transmission. Chin. J. Zoonoses, 13: 74-74.

Yan, W.Y., M.Y. Chen and C.C. Liu, 1995. Investigation of *Eperythrozoon* infection in workers of the food-industry in Saxian. Chin. Pub. Health, 15: 980-980.

Yang, D.X., X.Z. Tai, Y. Qiu and S. Yun, 2000. Prevalence of *Eperythrozoon* sp. infection and congenital eperythrozoonosis in humans in Inner Mongolia, China. Epidemiol. Infect., 125: 421-426.

Yang, Y.Z. and M.W. Sun, 1999. Investigation of *Eperythrozoon* infection in middle-school students in Fuyang city. J. Chin. School Health, 20: 147-147.

Yang, Y.Z., L. Guo, Z.Y. Li, G.L. Li and X.Q. Liu *et al*., 1999. Studies on *Eperythrozoon* infection in Fuyang city. Anhui J. Prev. Med., 5: 5-6.

Yang, Z., C. Yan, F. Yu and X. Hua, 2007. Haemotrophic mycoplasma: Review of aetiology and prevalence. Rev. Med. Microbiol., 18: 1-3.

Yun, X., X.Z. Tai, D.X. Yang and H.P. Yang, 1997. Investigation of *Eperythrozoon* infection in western parts of Inner Mongolia. J. Inner Mongolia Med. Coll., 19: 5-9.

Zhang, M.J., X.J. Lin and Y.M. Feng, 2002. Investigation of *Eperythrozoon* infection in inhabitants and outpatients in Yichuan city. J. Ningxia Med. Coll., 24: 60-61.

Zhou, C.X., C.Q. Wang, D.J. Wang, H.M. Pan and X.L. Zhou *et al*., 2007. Investigation of *Eperythrozoon* infection in the three-gorge dam area. Chin. J. Vector Biol. Cont., 18: 234-237.

Zhou, C.X., G.R. He, D.R. Zhou, X.Z. Huang and D.J. Wang *et al*., 2003. Investigation of *Eperythrozoon* infection in Xinshan area of the three-gorge dam. Chin. J. Parasit. Dis. Cont., 16: 9-9.

Zhu, M., L. Cai, L.Y. Wang, Z.Y. Wang and L. Shen *et al*., 2008a. Analysis of human *Eperythrozoon* infection in Shanghai. J. Pathogol. Biol., 3: 449-501.

Zhu, M., L. Cai, L.Y. Wang, Z.Y. Yu and X.B. Ma, 2008b. Epidemiological survey of *Eperythrozoon* infection in Shanghai. J. Trop. Med., 8: 155-157.