Analysis on The Epidemiological Features of Human Brucellosis in Inner Mongolia Province, China, with A Localized Plan to Prevent And Control The Disease

NAME: Yusi Liu
METRIC NUMBER: s2018310

Introduction and background

Brucellosis is a highly contagious zoonotic disease caused by Brucella spp, which can be transmitted from animal reservoirs, such as cattle, sheep, goats, and pigs, to humans through direct contact with infected animals or ingestion of unpasteurized animal products. It poses great challenges to public health, particularly in developing countries. It is rarely fatal, but has important impacts on the livestock economy due to loss of production in international markets, amounting to more than half a million new cases annually worldwide. It has been a huge problem in northern China since the first report in 1905.

Brucellosis itself yields low mortality rates, but it can cause substantial disabilities and weaknesses to the human immune system. The clinical presentation can be acute, subacute or chronic, varying from joint, muscle and back pain to flu-like symptoms, and even more serious conditions in different organ systems. However, it most commonly targets the reproductive system, resulting in up to a 40% increase in fetal wastage during the early stages of pregnancy and up to 2% of fetal deaths during the later stages of pregnancy for expectant women.

Inner Mongolia Autonomous Region, my hometown, located along the northern border of China, in which very large minority ethnic groups reside. Stretching about 2,400 km from west to east and 1,700 km from north to south, Inner Mongolia shares a long international border with Mongolia (around 3,000 km) and a shorter border with Russia (less than 1,000 km). It has been most severely affected by Brucellosis in both humans and livestock since 1999, reporting the largest number of human Brucellosis cases across China, and accounting for approximately 40% of the total reported cases in China during 1999–2008, 47.2% in 2010, and almost 50% during 2005–2010. The situation is still worsening. Most of the patients in Inner Mongolia are farmers or herdsmen, and are commonly infected from Brucella melitensis infected sheep (92%). Since human brucellosis is strongly associated with work and seasonality, the characteristics of the epidemic should be known, so as to provide evidence for disease control strategies.

Demographic data of human brucellosis

According to DI et al's study, for all of the diagnosed cases, 72.9% (n=10 162) and 30.2% (n=4214) of patients were confirmed by serological tests and bacterial culture, respectively. The median age of the cases was 42 (1-85) years (average of 41.81±12.22 years). Most of the cases were 25–59 years old with a percentage of 85.44%, although the susceptibility of human brucellosis was generally considered equal in all populations. The proportions of children (<15 years old) and elderly (⩾60 years old) were 1.43% and 7.21%, respectively. The number of male

patients (n=10, 114) was much more than female patients (n=3824) with a sex ratio of 2.64. The occupational distribution of human brucellosis over the 11-year period was also analyzed. As shown in figure 1, the majority of the patients were agriculturalists and pastoralists, who accounted for 81.9% and 12.4% of cases, respectively.

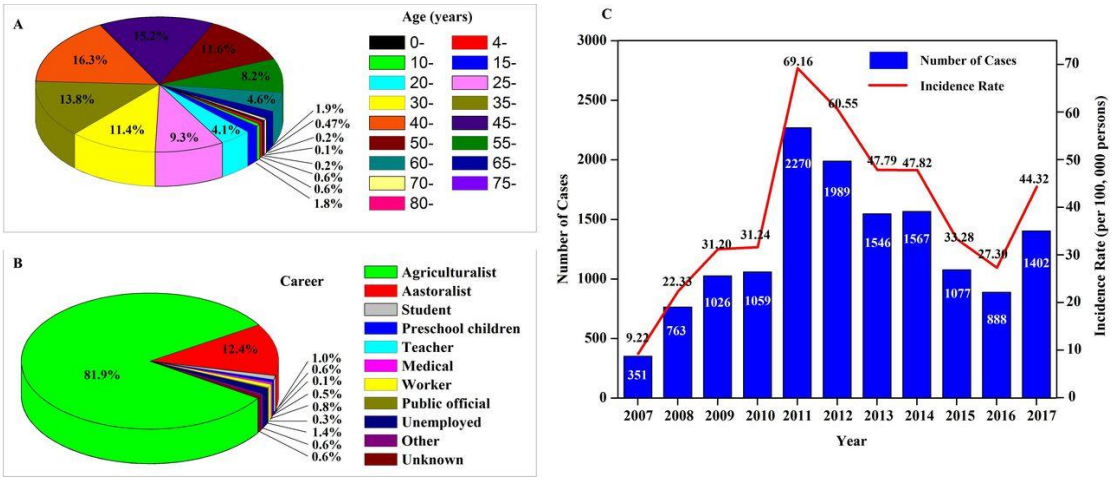

Figure 1, (Di et al.)

Seasonality of reported brucellosis cases

In the available data from 2007 to 2017, the maximum number of cases in a month was in May 2011 with 323 cases of the disease, and the minimum number was 11 cases, in November and December 2007. There was an apparent seasonality of human brucellosis, and the highest incidence reported was from March to July accounting for 58.6% of the total cases during the study period. The number of monthly cases reported peaked in April. However, it trended to monthly anterior displacement since 2012, with a huge number of cases (14.0%–25.6%) seen in January and February during 2012–2017. In conclusion, during the late spring in 2011, 2012 and 2013, there are highest numbers of cases.

Geographic Distribution

Most (99.3%) cases were reported in northern China during 1955–2014, and most provinces in northern China experienced a serious epidemic during the 1950s through the 1970s. Incidence subsequently decreased from the late 1970s through the early 1990s and the disease reemerged in the mid-1990s with cases reported almost every year. The 5 provinces with the highest median incidence rates during 1955–1994 were Tibet, Qinghai, Shanxi, Xinjiang, and Inner Mongolia; during 1995–2014, highest incidences shifted to Inner Mongolia, Shanxi, Heilongjiang, Jilin, and Hebei.

Similarly, the incidence in southern China has increased since 2000, and human brucellosis has emerged or reemerged in all provinces of southern China. Cases have been reported in almost every province and year since 2010. This finding contrasts with the distribution of brucellosis before 2000, when the disease was limited to a few provinces in southern China, such as Sichuan, Guangxi, and Guangdong. Additionally, the proportion of imported cases was higher in southern than northern China, but cases in southern China had a longer lag

from illness onset to diagnosis than did those in northern China.

A multidisciplinary approach

To prevent and control Brucellosis in China, a joint effort from the economy, agriculture animal husbandry and public health is needed.

From the economy side, it is advisable to provide local people with other job opportunities for industrial transformation, for example, from animal husbandry to tourism. The reason is that sheep and goats are still considering to be the one of the most important livestock and local people make their living by selling them. The number of livestock dramatically increased during the past 3 decades (e.g., the yearly numbers of cattle for meat production increased from 3.3 million in 1980 to 46.7 million in 2011, and numbers of sheep and goats increased 6-fold), which would have resulted in an increase of the total population of infected animals, even with low-level constant seroprevalence in livestock. The spatial distribution of human brucellosis apparently overlaps with livestock density, especially high densities of sheep and goats, and high incidences of human brucellosis tended to occur most commonly in grasslands at moderate elevation, where sheep and goats are the predominant livestock. As a result, if there are other better job opportunities, the density of sheep and goats may decrease and so does the incidence of Brucellosis.

Professionals in the agriculture animal husbandry industry should promote a better mode for raising, herding, slaughtering and transporting the animals to minimize the possibility of getting infected, including simultaneous disinfection, vaccination, regular sheep surveillance. The intensive modes of production, which accounted for the rearing of only 42.9% of cattle and 51.1% of sheep and goats in 2011, along with poor infrastructure and lack of high-standard and standardized protocols for maintaining good hygiene within the production cycle, might also result in increasing infections. Hence persons engaged in livestock husbandry, production, and trade are at high risk for brucellosis infection because of occupational exposure. Additionally, animal products supplied from brucellosis-endemic areas that have not undergone quarantine or pasteurization might increase the risk for infection in nonoccupational populations and urban settings, which might create extra challenges for disease prevention and case management. Vaccination is an effective method to reduce brucellosis incidence in livestock and correlates to a decrease in reported human cases, although no vaccines are available for humans. Therefore, susceptible livestock animals as the host and infection source for human infections are key to brucellosis prevention and control.

Public health workers should promote related health education and health literacy to local people in a way that they could accept the knowledge easily. And CDC may need to visit those villages from time to time to have a better grasp of the situation. Most of the patients were living in rural areas with lower prevention awareness and far from the Center of Disease Control and Prevention (CDCs), the most important of disease prevention and monitoring units in China, leading to the increased risk of infection and inaccessible treatment service. Otherwise, the annual incidence rates were maintained at lower levels. Besides, like in some

cities, a special treating center for this disease should be set so that more targeted and experience health care workers can be gathered to provide a better treatment for the patients. And the patients do not need to visit different levels of hospital to be diagnosed, missing the best opportunity of time to control the disease.

Local environment of raising goats, photo by Yusi in February, 2021

Conclusion

Human brucellosis can be controlled by reducing the breeding size of livestock or enhancing the culling rate of infectious livestock. However, the government should find the right balance among several control problems in epidemics, although the quarantine-slaughter-immunization strategy had been proven effective in the past decades. To achieve the targets for brucellosis reduction, improvements are needed in socioeconomic parameters, diagnostic and notification systems in animals and humans, and the high prioritization for eliminating the disease in livestock. The continuing existence of human (and animal) brucellosis in China, with potential for further increases in incidence, indicates that the control of brucellosis will not be an easy task without taking a One Health approach, integrating health professionals from the human and animal sectors and administrations. This effort extends beyond medical and veterinary duties and encompasses economic and even political factors.

References:

1. Li D, Li L, Zhai J, et al. Epidemiological features of human brucellosis in Tongliao City, Inner Mongolia province, China: a cross-sectional study over an 11-year period (2007–2017). BMJ Open 2020; 10: e031206. doi: 10.1136/bmjopen-2019-031206

2. Jia, P., Joyner, A. Human brucellosis occurrences in inner mongolia, China: a spatio-temporal distribution and ecological niche modeling approach. BMC Infect Dis 15, 36 (2015). https://doi.org/10.1186/s12879-015-0763-9

3. Jelastopulu, E., Bikas, C., Petropoulos, C. et al. Incidence of human brucellosis in a rural area in Western Greece after the implementation of a vaccination programme against animal brucellosis. BMC Public Health 8, 241 (2008). https://doi.org/10.1186/1471-2458-8-241