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A COMPARTIVE STUDY OF THE TRENDS IN EPIDEMIOLOGICAL ASPECTS OF TETANUS INFECTIONS AMONG KOREAN AND JAPANESE FROM 2010 TO 2015

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ABSTRACT

Background and Methods: To compare the comparative quantitative analysis of the epidemiological aspects of tetanus infections among Korean and Japanese since from 2010 to 2015. The raw data analyzed in this study were obtained from the websites of tetanus infections by the Korea Center for Disease Control and Prevention (KCDC) in Korea and the National Institute of Infectious Diseases (NIID) in Japan, 2010-2015. **Results:** We observed tetanus 117 cases with cumulative incidence rate (CIR) per 100,000 populations in Korea during the period from 2010 to 2015 were as 0.039 per 100,000 populations and with a total of 4 fatal cases, corresponding to a cases fatality rate (CFR) of 3.4%, respectively. During the same period in Japan, 716 tetanus cases with a CIR of 0.094 and with a 52 fatal cases to a CFR of 7.3% were observed. When compared, the CIR of tetanus in Korea was much lower than that in Japan ($p<0.01$). However, Korea and Japan, the case-fatality rates and the tetanus affected both sexes (male to female morbidity ratio: MFMR) were statistically not significantly difference levels between Korea and Japan. In both countries, the incidence of tetanus was highest among those aged 40 years and older, and outbreaks peaked in summer ($p<0.01$). Significant differences were observed in the incidence of tetanus cases between the capital city and county areas in both two countries ($p<0.01$). These differences in tetanus risk factors reflect the different influences of reservoir/host, climate and geographical and environmental characteristics, and variation in their activities for lifestyle or industrialization. **Conclusion:** Tetanus in Korea and Japan an emerging zoonosis, a serious concerned to the public health. Therefore, the development a health education for tetanus prevention and improvement of the living environment will aid in reducing from sources of infection.

KEYWORDS: Tetanus, Epidemiological aspects, risk factors, Korea, Japan.

INTRODUCTION

Tetanus is a highly lethal zoonosis contracted through exposure to the spores of the bacterium, *Clostridium tetani* that exists worldwide in soil and in animals and as such can contaminate many surfaces and substances. However, due to the introduction of the vaccination program and the advance of public health, tetanus is now uncommon in the developed countries.[1,3] Furthermore, currently, tetanus primary affects older adults because of their higher rate of being unvaccinated or of being inadequately vaccinated.[1,5] In Korea, a nationwide childhood vaccination with tetanus toxoid began in 1956 and that of Japan was introduced in 1948, 1949, 1958 and 1960, respectively and improved wound management has resulted in a decrease of tetanus.[2,4] While major efforts have been made to increase immunization coverage among children, very little attention has been paid to immunization against tetanus among adults. Thus the risk of tetanus may increase with morbidity and mortality especially in old age groups.[1,4] Tetanus occurs worldwide but is most frequently encountered in densely populated regions in hot, damp climates with soil rich in organic matter. Moreover, *C. tetani* are found primarily in the soil and intestinal tracts of animals and humans.[1,3,5,6]

In light of this situation, in Korea the Infectious Disease Control and Prevention Act classified human tetanus among group IV notifiable infectious disease.[7] Japan's Infectious Disease Control Law also has classified human tetanus as a category V notifiable infectious disease.[8]

Recently, there has been a marked decreases in new cases of tetanus in both Korea and Japan; however, reported cases still occur.[2,4,7,8] Therefore, understanding the epidemiological aspects and major risk factors of tetanus outbreaks in Korea and Japan provides data necessary for performing risk assessment and stabling in public health policies. Korea and Japan are geographically close to each other and share similar socio-cultural characteristics for the environment and

lifestyle. The spatial distribution of reported cases of tetanus is influenced by local geography and topology and at least in both countries, the incidence are associated with outdoor or field works and activities, particularly in the older age groups from whom the outbreaks could have been prevented by vaccination.[2,4,7,8]

In this comparative descriptive study, we investigated the epidemiological aspects of the reported tetanus cases in Korea and Japan between 2010 and 2015 and compared the demographic risk factors of the cases between the two countries.

MATERIAL AND METHODS

In order to accomplish this, we analyzed the data on national incidence, (cumulative incidence rate; CIR) and case-fatality rate (CFR), gender, age, seasonality of the year and habitat of the outbreaks for reported cases of tetanus. The raw data on confirmed tetanus cases in Korea (n=117) were obtained from the National Notified Disease Surveillance System of Korea Center for Disease Control and Prevention (KCDC); an agency of the Ministry of Health and Welfare from 2010 to 2015.[7] Data on reported tetanus cases in Japan (n=716) were obtained from the National Institute of Infectious Disease (NIID) in Japan from 2010 to 2015.[8] In order to assess differences among the epidemiological aspects within both countries, we used Pearson's chi-square test or paired *t*-test. The analyses were performed using Excel 2010 (Microsoft Corp., Redmond, WA, USA). Results were considered statistically significant for *p*-values less than 0.05.

RESULTS AND DISCUSSION

Table 1 shows the comparative observation of the epidemiological aspects of tetanus in Korea and Japan between 2010 and 2015. In Korea, we observe tetanus 117 cases with cumulative incidence rate (CIR) per 100,000 populations during the study period from 2010 to 2015 was 0.039 per 100,000 populations (95% CI, 0.032-0.046) and annual incidences were in the range of 0.03-0.04 recorded, with a total of 4 fatal cases, corresponding to a CFR of 3.4%, respectively. During the same period in Japan, 716 tetanus cases with 0.094 per 100,000 populations (CI, 0.093-0.095) and annual incidences were in the range of 0.084-0.102, and with a 52 fatal cases to a CFR of 7.3% was observed. When compared, the CIR of tetanus in Japan was much higher than that in Korea ($p<0.01$). However, the CFR of tetanus patients in both Korea (3.4%) and Japan (7.3%) was statistically not significantly different level. These differences could be attributed to the divergence in the environmental sources of infection, where tetanus vaccination protected only vaccinated individuals.[1,5] It is remarkable that nearly all of the cases in the United States occur in unimmunized individuals or individuals who have allowed their inoculations to lapse.[5,9] Our results also show that in both countries, tetanus affects both sexes equally, accounting for 0.95 and 1.22 of MFMR in Korea and Japan, respectively. Thus remarkably, tetanus affects both sexes.[1,3,9] No overall gender predilection has been reported, except to the extent those males have more soil exposure in some cultures. In the United States from 1998 to 2000, the incidence of tetanus was 2.8 times higher in males aged 59 years and younger than in females in the same age range.[3]

When we classified tetanus cases in Korea by age-adjusted group, 0% of the cases were aged 19 years or younger, 10.3% were 20-39, 27.3% were aged 40-59 and 62.4% were aged 60 years or older. In Japan, the proportions for the same age-adjusted groups were 1.8%, 4.5%, 15.5% and 78.2%, respectively. The proportion of cases differed significantly by age-adjusted group within both countries ($p<0.01$). This age-adjusted distribution also differed within both countries, with 89.7% and 93.7% of the cases occurring in individuals aged 40 years or older in Korea and Japan, respectively (Fig.1). However, in both countries, these age distributions might reflect the increasing trend towards migration of young people from rural endemic areas to urban areas for employment, leaving elderly relative to work in the outdoor or field activities.[1,10] On the other hand, remarkably, the risk for development of tetanus and for the most severe form of the disease is highest in the elder population. In the United States, 50% of the cases and 75% of the deaths occur in persons aged 60 years or older.[1,3,5] When we analyzed the seasonal pattern of reported tetanus cases in Korea, we found that 23.1% of the cases occurred in spring, 39.3% in summer, 24.8% in autumn and 12.8% in winter, demonstrating significant seasonal variation in the distribution of cases ($p<0.01$). In Japan, the proportions for these seasons were 25.7%, 32.8%, 26.0% and 15.5%, respectively, again representing significant seasonal variation ($p<0.01$). This seasonal distribution revealed that reported cases were more frequent in summer and this seasonal effect was little more distinct in Korea compared to Japan.

We also compared the incidence of tetanus cases by the habitat between the capital cities of each country, both intensely urbanized, as well as other regions including rural communities. In Korea, 14 cases (12.0% of total cases) were reported in capital city of Seoul between 2010 and 2015. In comparison, 103 cases (88.0% of total cases) were reported in the counties, demonstrating a significantly higher incidence than the capital city of Seoul. Conversely, in Japan, 34 cases (4.8%) were reported in the capital city of Tokyo, while 682 cases (95.2%) were reported in other regions (counties), suggesting the lack of a significant regional variation. A significantly higher proportion of cases was observed in county areas of Japan compared to Korea ($p<0.01$). In both Korea and Japan, a nationwide childhood vaccination with tetanus toxoid began in the early of 1950s and improved wound management has resulted in a decrease of tetanus outbreaks. While major efforts have been made to increase immunization coverage among

children, very little attention has been paid to immunization against tetanus among adults. Thus, the risk of tetanus may increase with age.[2,7] On the other hand, in Korea, during 2010 through 2015, the last years for which data have been compiled, a total of 117 cases were reported, an average approximation 20 cases per year and in Japan, reported in over 100 persons each year.[6,8] It is a highly lethal zoonosis and a disease of concern with regard to public and animal health.[6] Therefore, in Korea and Japan, like in other countries, obligatory vaccination tetanus cases in children and adolescents are very rare. Though, in older age groups, the recommended buter Tetanus and Diphtheria (Td) vaccination is often not respected and among people those people there are some cases of tetanus with marked case fatality. The deaths usually occur among those over 60 years old.[1,6,11] In addition, the CDC recommends that adults receive a booster vaccine every ten years[5,10] and standard care practice in many places is to give the booster to any patient with a puncture wound who is uncertain of when he or she was last vaccinated, or if he or she has had fewer than three lifetime doses of the vaccine. The booster may not prevent a potentially fatal cases of tetanus from the current wound, however, as it can take up to two weeks for tetanus antibody form.[1,5,10,12]

In conclusion, tetanus is an emerging zoonosis and a serious concern to public health measures of prevention and control. This study provides a retrospective assessment of quantitative ecological data concerning the epidemiological aspects and risk factors of tetanus in Korea and Japan and the elucidation of the reasons according to the differences between the two countries is imperative for the effective prevention of tetanus among residents of at-risk areas.

Table 1: Comparative observation of the epidemiological aspects and risk factors of tetanus cases in Korea and Japan, 2010-2015.

Item	KOREA		JAPAN	
Incidence	**Cases (rate)**	**95% CI**	**Cases (rate)**	**95% CI**
No. of cases	**117**		**716**	
CIR/100,000	**0.039**	**0.032-0.046**	**0.094****	**0.093-0.095**
Epidemic aspects	**Cases (%)**	**95% CI**	**Cases (%)**	**95% CI**
Fatal-cases	**4**		**52**	
Case-fatality rate	**3.4**	**0.1-6.7**	**7.3**	**5.4-9.2**
Gender				
Male	**57 (48.7)**	**39.6-57.8**	**393 (54.9)**	**51.3-58.6**
Female	**60 (51.3)**	**42.2-60.4**	**323 (45.1)**	**41.5-48.9**
MFMR (M/F)	**0.95**	**0.91-0.99**	**1.22**	**1.19-1.25**
Age-adjusted				
<19	**0**	**-**	**13 (1.8)**	**0.8-2.8**
20-39	**12 (10.3)***	**4.8-15.8**	**32 (4.5)**	**3.0-6.0**
40-59	**32 (27.3)****	**19.2-35.4**	**111 (15.5)**	**12.9-18.2**
>60	**73 (62.4)**	**53.6-71.2**	**560 (78.2)****	**75.2-81.2**
p-vale	**<0.01**		**<0.01**	
Seasonality				
Spring	**27 (23.1)**	**15.7-30.7**	**184 (25.7)**	**22.5-28.9**
Summer	**46 (39.3)**	**30.4-48.2**	**235 (32.8)**	**29.4-36.2**
Autumn	**29 (24.8)**	**17.0-32.6**	**186 (26.0)**	**22.8-29.2**
Winter	**15 (12.8)**	**6.8-18.9**	**111 (15.5)**	**12.9-18.2**
p-value	**<0.01**		**<0.01**	
Habitat				
Capital city	**14 (12.0)****	**6.1-17.9**	**34 (4.8)**	**3.2-6.4**
Counties	**103 (88.0)**	**82.1-93.9**	**682 (95.2)****	**93.6-96.8**
p-value	**<0.01**		**<0.01**	

CIR: cumulative incidence rate per 100,000. 95% CI: confident interval of 95%. Case-fatality rate in %. Statistically significant levels set at *p<0.05 and **p<0.01.

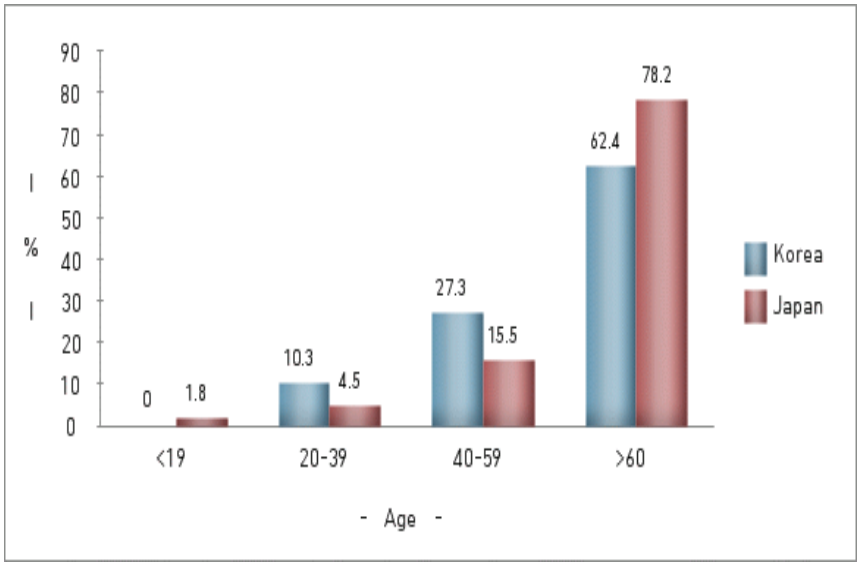

Fig. 1: Trends in distribution rates of human tetanus cases by age in Korea and Japan, 2010-2015.

Conflict of interest: None to declare.

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