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Investigation on Influenza A and B Virus from People Entering China via the Tianjin Port in 2019

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Abstract

Objective: To investigate the frequency of influenza A and influenza B infections in people entering China at Tianjin port during 2019, so as to provide the basis for preventing the spread and control of influenza A and influenza B virus in China, and preliminarily assess the risk of entry passengers.

Methods: The throat swabs of entry personnel at Tianjin port in 2019 were collected, and influenza A and influenza B virus in the samples were detected by quantitative RT-PCR. According to the collected passenger information, combined with the experimental results, classification was carried out, and the related factors influencing the positive of influenza A and influenza B virus were analyzed.

Results: A total of 1605 throat swabs were collected. The results of quantitative RT-PCR showed that there were 40 (2.5%) cases of influenza A virus positive. No significant differences were found in gender, age and country distribution. However, in terms of entry time, the positive rate of influenza A virus was the highest in the first quarter compared with other quarters, and the difference was statistically significant. At the same time, there were 13 (0.8%) cases of influenza B virus positive in this survey. No significant differences were found in gender, country distribution and entry time, but in terms of the age of entry personnel, the positive detection rate of children and young people with influenza B infection was higher, and the difference between different age groups was statistically significant.

Conclusions In 2019, Chinese accounted for the majority of the entry personnel at Tianjin port. The detection rates of influenza A and influenza B virus were low, while the total number of foreign immigrants was small, and the detection rate was high. The positive rate of influenza A and influenza B among different genders was similar. The positive detection rate of influenza A virus in the first quarter and influenza B virus in adolescents were relatively high. These two groups of people posed a threat to public health safety in China. Therefore, Therefore, we should focus on prevention and monitoring of key population at ports.

Introduction

Influenza is an acute respiratory disease caused by influenza virus. It has strong infectivity and fast transmission speed, which is similar to the common cold symptoms and is not easy to be noticed at first. Influenza is a kind of infectious disease that does great harm to human beings and seriously threatens human health. Influenza virus, which is the pathogen of influenza, belongs to Orthomyxoviridae[1,2], and can be divided into three types: A, B and C according to the different nucleoprotein and matrix protein of influenza virus[3]. Of which, influenza A virus can be divided into many subtypes according to the structural changes and biological characteristics of

hemagglutinin (HA) and neuraminidase (NA). HA can be divided into 18 subtypes (H1-H18) and N has 11 subtypes (N1-N11)[4]. Influenza A has caused worldwide pandemics for many times and influenza B has caused epidemics, while influenza C virus is often sporadic and does not cause serious diseases[5,6]. Tianjin is a national central city, located in the economic center of Bohai Rim region. With rapid economic development, large population mobility and high risk of epidemic diseases, it is very important to strengthen epidemic surveillance at ports to prevent the epidemic and spread of diseases in China. This study aimed at investigating the isolation frequency of IFVA and IFVB from people entering Tianjin port in 2019.

Method

Sample information

Throat swab samples were collected from the cruise home port of Tianjin port from January 1, 2019 to December 31, 2019, and the corresponding information database was established to record the sex, age, nationality and collection time of the immigrants. All samples were tested for influenza A and influenza B virus nucleic acid. The test procedure was completed by Tianjin International Travel health care center according to the strict inspection process.

Nucleic acid detection of influenza A and B virus

The collected samples were numbered, and a positive and negative control and blank control were set for the detection position of influenza A and B virus on each board. The operation steps and the required reagent amount were carried out according to the instructions of the instrument. The nucleic acid extraction was carried out with the reagents provided by the ABI kit in the ABI magmax express instrument to extract the required nucleic acid. Using the fluorescent PCR kit provided by Guangzhou Zhaokang Biotechnology, the extracted nucleic acid was amplified and detected by ABI step-one fluorescent quantitative PCR instrument, and the results were judged according to the CT value. The primers and fluorescent probe used for detection in this study were as follows:

IFVA-F 5'-GACCRATCCTGTCACCTCTGAC-3'

IFVA -R 5'-GGGCATTYTGGACAAAKCGTCTACG-3'

IFVA -P 5'-TGCAGTCCTCGCTCACTGGGCACG-3'

IFVB-F 5'-TCCTCAACTCACTCTTCGAGCG-3'

IFVB -R 5'-CGGTGCTCTTGACCAAATTGG-3'

IFVB -P 5'-CCAATTCGAGCAGCTGAAACTGCGGTG-3'

The remaining RNA was stored in a refrigerator at - 80 °C.

Statistical analyses

The means, standard deviations, standard errors, and statistics analyses were calculated or performed by Prism software version 5.00. Fisher's exact test was performed to evaluate the statistical difference in the positive rate. Differences with $p< 0.05$ were considered to be statistically significant.

Results

The regional distribution of positive detection rate of influenza A and B virus

The data collected are summarized in Table 1. In 2019, a total of 1605 throat swabs were collected from Tianjin port and the positive rate of influenza A and B virus were 2.5% and 0.8%, respectively. After screening the effective information, the subjects were from the Philippines, South Korea, India and China. In terms of regional distribution, the positive detection rate of influenza A virus is generally higher than that of influenza B virus, but there is no

Table 1. The comparison of nucleic acid detection of influenza A and B virus results with different characteristics

Feature	Number	Constituent ratio	Positive rate of IFVA	Positive rate of IFVB
Country				
Philippines	18	1.1%	5.6%	0
Republic of Korea	23	1.5%	4.3%	0
India	15	0.9%	6.7%	0
China	1549	96.5%	2.4%	0.8%
x^2 value			2.165	0.474
p value			0.539	0.925*
Sex				
male	866	54.0%	2.0%	0.6%
female	739	46.0%	3.1%	1.1%
x^2 value			2.167	1.267
p value			0.141	0.26
Age				
0-10	175	10.9%	4.6%	1.7%
11-20	83	5.2%	3.6%	0
21-30	509	31.7%	2.8%	0.6%
31-40	358	22.3%	2.9%	1.1%
41-50	211	13.1%	1.4%	0
51-60	162	10.1%	0.6%	0.6%
>60	107	6.7%	0.9%	1.9%
x^2 value			8.223	21.774
p value			0.222*	0.001*
Time				
First quarter	422	26.3%	7.1%	1.2%
Second quarter	315	19.6%	1.3%	1.0%
Third quarter	375	23.4%	1.6%	0
Fourth quarter	509	31.7%	0	1.0%
x^2 value			53.702	4.107
p value			0	0.25*
Total	1605	100%	2.5%	0.8%

significant difference between the positive rate of influenza A and influenza B among people in different regions, for details see attached Tables 1.(X^2=2.165, P=0.539, X^2=0.474, P=0.925)

The gender distribution of positive detection rate of influenza A and B virus

In this study, the positive detection rate of influenza A virus in male samples was 2.0% (17/866) and that in female samples was 3.1% (23/739). There was no significant difference in the detection rate between different genders (X^2= 2.167, P = 0.141); in addition, the positive detection rate of influenza B virus in male samples was 0.6% (5/866) and that in women was 1.1% (8/739), and there was no significant difference between different genders (X^2=1.267, P=0.26).

The age distribution of positive detection rate of influenza A and B virus

All subjects were divided into 7 groups according to their ages: 0-10 years old, 11-20 years old, 21-30 years old, 31-40 years old, 41-50 years old, 51-60 years old and over 60 years old. In different age groups, the highest positive detection rate of influenza A virus was 0-10 years old, the positive detection rate of virus was 4.6%, while the lowest age group was 51-60 years old, the positive detection rate was 0.6%. There was no significant difference in the positive rate of influenza A virus among different age groups (X^2= 8.223, P = 0.222). However, the detection rate for influenza B virus was higher in the age group of 0-10 years and > 60 years old. There was significant difference in the positive detection rate of influenza B virus among different age groups (X^2= 21.774, P = 0.001).

The entry time distribution of positive detection rate of influenza A and B virus

The outbreak of influenza virus infection is greatly affected by temperature. Through the analysis and investigation of samples from different quarters, it can be seen that the positive detection rate of influenza A virus is the highest in the first quarter, up to 7.1%, and the lowest in the fourth quarter. The positive detection rate of influenza A virus in different quarters has statistical significance (X^2= 53.702, P = 0). The positive rate of influenza B virus was the highest in the first quarter, and the lowest in the third quarter. However, there was no significant difference in the positive rate of influenza B virus between different quarters (X^2= 4.107, P = 0.25).

Discussion

Besides people, the natural hosts of influenza A virus also include many animals, such as water birds, pigs, etc., and it is believed that pigs are the main site of gene recombination between human and avian influenza A virus. Therefore, the mutation of influenza A virus is not only the antigenic transformation caused by point mutation or multi-point mutation but antigenicity transformation caused by gene reassortment of animal origin. All these changes will lead to the emergence of new subtypes, which is also the main reason for influenza A virus pandemic[7]. In 1940, Francis isolated influenza B virus from human population. So far, there is no other natural host of influenza B virus except infecting human beings, which is different from influenza A[8,9]. Influenza B virus can only escape the surveillance and elimination of human immune system by antigenic drift, but its evolution speed is slower than that of influenza A virus[10]. Tianjin, with its cruise home port and airport, is the center of China's trade and economic development. Due to the needs of life, study and work, there is a large number of people flowing. Compared with Chinese immigrants, the number of foreigners is small, so there may be some errors between the data analysis and the actual situation. In this study, the vast majority of people entering Tianjin port were from China, and the positive rates of influenza A and B were 2.4% and 0.8% respectively. It should also be noted that there are many IFVA types and subtypes found in China, and the probability of the entry of influenza virus into China is relatively high. Therefore, it is necessary to strengthen port monitoring and control to prevent the introduction and spread of influenza virus.

In this study, the number of men and women entering Tianjin port in 2019 is relatively similar, and the positive rate of influenza A and B virus in women is higher than that in men. However, there is no significant difference in the positive rate between different genders, which is similar to the study of Zhang Minhui et al.[11], but different from that of Li Yan et al.[12,13]. This may be related to the fact that women prefer going to places with large numbers of people such as shopping malls or tourist resorts, which may increase the risk of infection with epidemic diseases.

In terms of age distribution, the immigration population at Tianjin port of 2019 is concentrated in the age range of 0-40 years, of which 21-30 years old accounts for the majority, accounting for 31.7%. According to the distribution of influenza virus positive people in different age groups, the three age groups with the highest detection rate of influenza A virus were 0-10 years old (4.6%), 11-20 years old (3.6%), 31-40 years old (2.8%). At the same time, in the detection of influenza B virus, the positive detection rate of 0-10 years old was the highest (1.7%), followed by 31-40 years old (1.1%). The overall positive detection rate of influenza B virus was generally lower than that of influenza A virus. Due to the influence of life, study, work and other factors, young and middle-aged people have a wide range of activities and frequent activities, and the positive detection rate of influenza A and B virus is high.

Compared with other quarters, the positive detection

rate of influenza A and B in the first quarter was higher, and the difference was statistically significant. This shows that in Tianjin, the influenza virus was relatively active in the first quarter. The temperature began to rise in this quarter, but it was still low. At the same time, the weather was relatively dry, which was conducive to its own spread, and people were vulnerable to influenza. This is similar to the previous peak time in northern China[14-16].

Influenza is mainly transmitted through droplets in the air, people to people or people to people contact with contaminated goods, with high transmission speed and strong infectivity[17]. Therefore, in order to improve the influenza virus monitoring work at Tianjin port, we must pay attention to: firstly, focus on the young and middle-aged groups, especially 0-10 years old group, and a good treatment mechanism should be established. secondly, focus on the observation of influenza virus carrying situation of entry personnel in the first quarter, and pay special attention to the personnel with typical symptoms. Thirdly, we should also develop good living habits, wash hands frequently and have more ventilation. In addition, in the high incidence season of influenza, it is necessary to avoid crowded places, strengthen physical exercise and enhance physical resistance.

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