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Travel Medicine and Infectious Disease 36 (2020) 101787

Contents lists available at ScienceDirect

Travel Medicine and Infectious Disease

journal homepage: www.elsevier.com/locate/tmaid

Reflection on SARS-CoV-2 infection of container ship seafarers

Dear Editor,

As reported by Carole Eldin et al. [1], SARS-CoV-2 may easy travel together with their human carriers and spread the virus in-flight. Furthermore, maritime transport and freight forwarding enterprise are challenged with a rising concern on crew health and virus spreading, putting the whole world in the dilemma of shipping or not. Zhoushan Port (Ningbo, China) is one of world's busiest port for global comprehensive transportation with cargo throughput ranks first in the world for eleven consecutive years. On late March 17, the Danish ship "Gjertrud Maersk" (affiliated to the Maersk Line, headquartered in Copenhagen) arrived at the outer anchorage of Zhoushan Port and requested permission to dock, with 22 foreign crew on board. On March 18, the local authority was informed by the ship's agent that some of the crew were not in a good health condition. After active correspondence, local custom staff boarded the ship for inspection, and seven crew members were reported "in abnormal physical condition" on March 20. With repeatedly discussion and coordination on the treatment plan, on March 26, seven reported crew members were transported to Ningbo Hwa Mei Hospital, University of Chinese Academy of Sciences, and the rest were kept on board under medical observation. So far, there has been five confirmed cases of SARS-CoV-2 infection (three symptomatic and two asymptomatic) and two excluded with nucleic acid testing negative four times consecutively. The fifteen crew members on board were reported in good status. Upon our display and analysis of epidemiological and clinical data of the five infected cases, we hope to provide a preliminary reference for early identification and effective management of such international event during the pandemic.

Five patients were positive for virus nucleic acid tests on pharyngeal swabs. All of them were Filipino male, aged 23–50 (37.8 ± 3.3) years. Except for one case with a history of hypertension, the rest of them were in a generally healthy condition. All these five SARS-CoV-2 infected cases boarded in Hong Kong, China on February 27 and stayed on board ever since. **Case 1** had a fever since March 19, with a peak temperature of 39.7 °C and afebrile 4 days later with medication (acetanilide and antibiotics). **Case 2** had a persistent cough and pharyngeal pain since March 12, and no relief despite medication (acetanilide). **Case 3** developed a mild cough on March 10 with slight white sputum, and the symptom disappeared two days later after medication (acetanilide). The other two cases had no obvious clinical symptoms. The five cases above were found positive in SARS-CoV-2 nucleic acid test on pharyngeal swabs on March 24, and transported to the local designated hospital for isolation and treatment. During the hospitalization, CT scan, virus antibody and virus nucleic acid tests were performed. The timeline of the disease progression is shown in Fig. 1.

Notably, these five infected cases showed subtle and even no symptoms. Three of them took medications upon symptoms, which may interfere with clinical manifestations and test results. When assessing the transmissibility of an asymptomatic carrier, the three elements should be considered: the viral load, time of carrying virus, and the

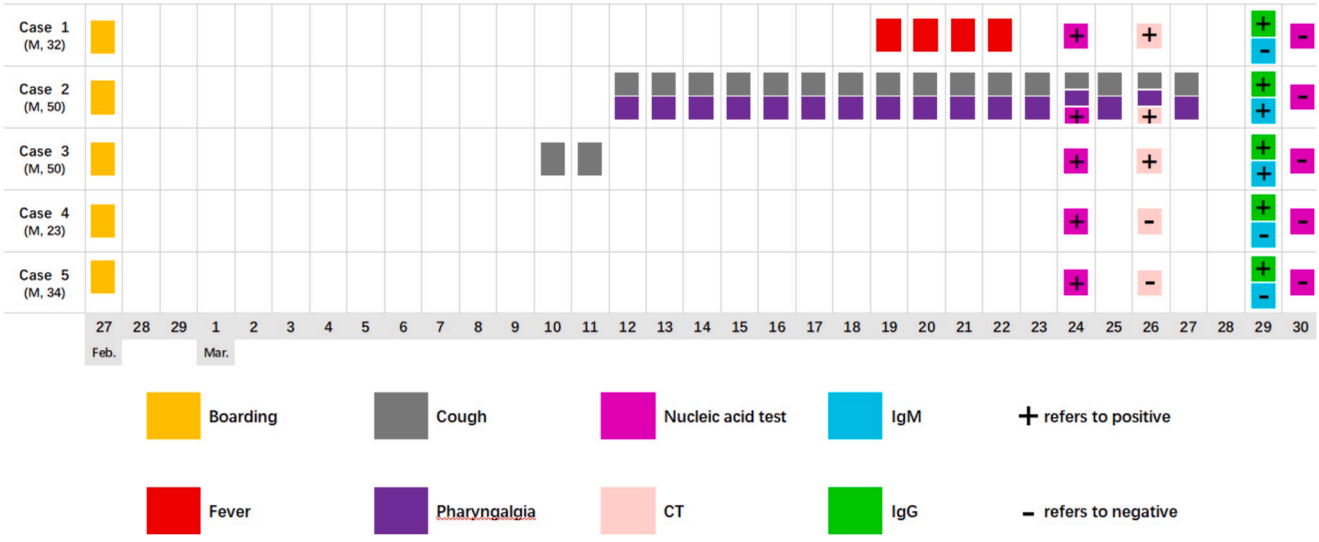

Fig. 1. The timeline of clinical manifestations, nucleic acid test, CT scan and virus serum antibody test of the five cases.

https://doi.org/10.1016/j.tmaid.2020.101787
Received 13 April 2020; Received in revised form 1 May 2020; Accepted 8 June 2020
Available online 10 June 2020
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behavior of the carrier, including whether a mask was worn, and his/her specific social activities [2–4]. Up until now, there is limited data on this issue, the conclusion on if asymptomatic carriers could be an intensified virus spreader or is mostly harmless need to be drawn prudently. CT findings of these five cases on admission varied a lot. Three symptomatic cases showed ground-glass opacity in the unilateral or bilateral subpleural area, and the other two asymptomatic cases showed no abnormal imaging findings, which are consistent with the findings of the Diamond Princess cruise report [5]. However, the sample size of our case is too small to further summarize such CT features of crew infection.

"Gjertrud Maersk" was originally scheduled to dock on ports in major cities including Ningbo, Shanghai, Xiamen, Colombo, Felixstowe, Rotterdam and others. Due to the COVID-19 cases, the ship is now berthed in Zhoushan Port, and will be thoroughly sterilized as part of the emergency response. The local CDC (Center for Disease Control and Prevention) took aggressive measures on contact tracing and implemented active medical observation on them, minimizing spreading between crew members and the port staff. China's Ministry of Transport, together with relevant departments, has been discussing matters including crew rotation and other work requested by laws and regulations.

Epidemiological investigation of Philippine crews before boarding in Hong Kong is an important clue to the source of the virus. Since the infection involved organizations in several countries and regions, we have not yet obtained accurate relevant data or official reports. Nevertheless, this crew infection has raised a worldwide concern. India, Australia, Turkey and other countries have implemented a 14-day quarantine towards ships entering the port, and there might be more countries adopting this measure and with a stricter inspection and control policies. Container shipping is crucial in transportation of global commodities, oil, food and other vital goods. However, the transnational route coming along also brought with increased risk of the disease spreading and even outbreaks. Therefore, the industry and the whole world need to be more prepared while proceeding shipping.

Funding

This study was supported by Key Research Foundation of Hwa Mei Hospital, University of Chinese Academy of Sciences, China (Grant No. 2020HMZD19 and No. 2020HMZD20).

Declaration of competing interest

The authors declare that they have no competing interests.

CRediT authorship contribution statement

Qi Dai: Conceptualization, Data curation, Writing - original draft, Writing - review & editing, Software, Formal analysis. **Supei Hu:** Conceptualization. **Kun Yan:** Data curation, Investigation, Resources. **Zhang Chen:** Writing - review & editing. **Bin Chen:** Data curation, Investigation, Resources. **Ting Cai:** Writing - review & editing. **Shun Zhang:** Data curation, Investigation, Resources. **Jingfeng Zhang:** Writing - review & editing, Project administration. **Jianjun Zheng:** Writing - review & editing, Funding acquisition, Supervision.

Acknowledgements

This study was approved by Ethics Committee of our hospital.

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[1] This study has neither been presented nor submitted or accepted anywhere.