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Shelter hospital mode: how to prevent novel coronavirus infection 2019 (COVID-19) hospital-acquired infection?

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With the rapid outbreak of coronavirus infection 2019 (COVID-19) there have been, as of March 15, 2020, 49999 confirmed patients in Wuhan city. Therefore, it is impossible for all those patients to be admitted to existing hospitals in Wuhan. The best solution is to build a shelter hospital in open areas such as stadiums or exhibition centers. However, concerns arise about hospital-acquired infections (HAIs). Built on February 5, 2020, there have been more than 12000 beds with approximately 9000 in-hospital patients. With such large number of patients, how can HAIs be prevented in these patients?

As of February 22, 2020 at the press conference of the State Council, there were 3019 infected healthcare personnel (HCP). Among them, 1716 HCP had confirmed infection and unfortunately, five of them died of COVID-19. More importantly, in Wuhan city, there were 1080 infected HCP. However, at the shelter hospital, with more than 5000 HCP, there has been no infected staff since February 5 till now. How were HAIs prevented in HCP? Here, we address the measures taken at the shelter hospital.

1. Disinfection of clean areas, semi-contaminated and contaminated areas.

For the contaminated areas, disinfection4 times daily, the environment, air, floor and the surface of tables are sprayed with a 2000 mg/L chlorine-containing disinfectant for no less than 30 minutes. For patient vomitus and secretions, the area is cleaned, and then the contaminated ground sprayed with 2000 mg/L chlorine-containing disinfectant. Medical waste and other wastes are placed in double-layered yellow garbage bags, which are tightly closed.

For the semi-contaminated and clean areas, the disinfectant contains 500 mg/L chlorine and disinfection is performed twice a day. However, if contaminated with blood or vomit, the floor should be cleaned then disinfected with 2000 mg/L chlorine-containing for 30 minutes. For the air disinfection, there are three methods: a window is opened and the area ventilated for no less than 30 minutes 2-3 times daily. The second way is the UV irradiation for 30 minutes (2 times a day). The third way is spraying with 500 mg/L chlorine-containing disinfectant for more than 30 minutes.

2. Patient related decontamination

All patients will be given new face masks every day. The patient living area is disinfected four times a day. For the discharged patients, all personal items will be sprayed with 75% EtOH. They change into clean clothes brought by their families after taking a hot bath for at least 30 minutes. All the remaining clothes are disinfected and discarded as medical waste. Subsequently, in clean areas, clothes worn by the patient are disinfected again prior to discharge. For items in the contaminated area used sheet and bedding are disinfected and discarded. Other items such as the mattress are disinfected and new bedding and sheets provided for newly admitted patients. Glasses, mobile phones, keys, credit cards and other items are sprayed with 75% EtOH.

3. Healthcare personnel related disinfection

Before entering the shelter hospital, all HCPs wear protective equipment in the following sequences: white coats, N95 facial masks, surgical masks, surgical hats, protective goggles, shoe covers, isolation gowns, gloves, protective suits, another pair of gloves, protective hoods and boot covers. All staff entering and exiting the shelter hospital should be recorded.

For the exiting of the shelter hospital, it includes several steps. Firstly, the HCP should disinfect the hands, and 75% EtOH is sprayed over all protective clothing. Then they will enter the buffer room, where they will perform hand disinfection and spray 75% EtOH over all protective clothing again. After this step, they enter the first changing room, which is also contaminated. In this room, they will take off the first layer of gloves, and then put on new clean gloves to take off the protective hood, protective suit, protective goggle and surgical mask sequentially. After taking off each protective item, they repeat hand hygiene. After taking off the surgical mask and disinfecting the hands, the HCP enters the second changing room, which is considered semi-contaminated. In that room, they take off the isolation gown, surgical hat, N95 face mask and gloves. In addition, hands are disinfected frequently and then put on a clean surgical mask to enter the clean area. At the clean area, the body temperature is determined and recorded.

4. Occupational exposure

Occupational exposure includes skin, mucosa, and, respiratory exposure and needle sticks in HCP from confirmed patients. For the skin exposures, disinfection with 0.5% iodine or H_2O_2 for 3 minutes is performed, and then wiped off with clean water. For the mucosal exposures, HCPs should rinse the exposure site with 0.9% saline or 0.05% iodine. For the needle sticks, HCP should squeeze the blood out and rinse the wound with flowing water, and then sterilize with 75% EtOH or 0.5% iodine. For the respiratory exposures, the mouth and nose of HCP are not protected by a facemask within a 1 meter distance of an unmasked confirmed patient. For damaged gloves, HCP should disinfect the hands with 0.5% iodine or H_2O_2 for 3 minutes and then rinse with copious water. Finally, they should leave the contaminated area and report exposures infection control personnel.

Following all these strategies listed above, we successfully prevented HAIs at shelter hospitals, which have more than 900 patients per open area in each hospital. Up to now, there has been no occurrence of HCP infection by COVID-19 at shelter hospitals. Therefore, our experience proved to be efficacious and successful for hospital infection management and prevention during the outbreak of COVID-19.

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Potential conflict of interest

The authors declare that there is no conflict of interest.