



THE FIGHT AGAINST THE DISEASE OF THE CORONAVIRUS 2019 (COVID-19): MANAGING OF EMERGENCY AND CONTROL INFECTIONS IN ONE RADIOLOGY UNIT.

Radiology

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ABSTRACT

Objective: Describe the strategies, management of emergencies and procedures to control infections in our department during the outbreak of the 2019 coronavirus (COVID-19).

Methods: We created one team for the management of emergencies. The team established several measures: Reconfiguration of the flow of work in the department of radiology, distribution of material protection staff and training of personnel, procedures for obtaining of images in patients suspected or confirmed with COVID-19, as well as for patients with no history of exposure or symptoms. Those with suspicion or confirmation of COVID-19 were scanned in one unit dedicated to it.

Results: From January of 2020 until April of 2020, 3,293 people with suspicion or confirmation of COVID-19 received CT Thorax. Including the tests initial and repeated, the number total of CT was 3,520. As a result of our measures of precaution, none of the members of the staff of the department of radiology was infected with COVID-19.

conclusion: The strategies of planning and appropriate protections may help to protect the patients and staff against a highly infectious disease and at the same time help in maintaining the ability to meet high volume of patients.

KEYWORDS

Coronavirus, COVID-19, infection control, new coronavirus pneumonia

INTRODUCTION

The whole world has been focusing on the outbreak of the respiratory disease caused by the new coronavirus the which was reported for the first time in Wuhan, China WHO called the disease as " coronavirus 2019" (COVID-19).

The CT Scan can play important role both in the diagnosis and in the classification of the COVID-19 based on the definitions issued by the WHO and guidelines for treatment of the NHC [1-4]. The procedures of isolation and prevention are necessary to protect both the department personnel as the other patients in the hospital. It must be considered that the CT is not useful as a tool for screening due to the fact that radiological findings of COVID-19 are also present in other respiratory diseases. But it can help to determine the degree of lung involvement and course of the disease.

This article describes the procedures for handling of emergency in our unit of radiology for situations that involve serious infectious diseases and the experiences of staff of the unit on the protection from infections.

METHODS

The hospital provided equipment to protect personnel (protective clothing, surgical cap, N95 mask, gloves, cloth masks and goggles) to all health care staff, and build three medical tents (tents of fever) for the evaluation of patients with fever in the parking lot of the department of emergency, designed a procedure and designated an area specified for the examination of patients with suspicion of the disease. The patients confirmed with COVID-19 were placed in one room for isolation. "Fever" was the term colloquially used to designate the patients suspected with COVID-19 based on symptoms such as fever or history of possible exposure, as well as those cases confirmed with COVID-19 referred to treatment. In addition, during the outbreak, the patients of emergency with epidemiological history were sent to the tents of fever if they meet the criteria of suspicion.

Our department has team of radiologists and other staff members (technologists, nurses, engineers, and support staff). The team of the department of radiology includes members of MRI, CT, Digital Angiography (DSA), digital radiography, PACS workstations.

The first building, located at the side of the department of emergency, was reconfigured to handle the cases of COVID-19. They set up tents for fever in the parking lot of the department of emergency to separate the patients with emergencies and with symptoms of or history of exposure to COVID-19. To avoid the cross contamination, we established different points of access for both tents and for areas of examination of the unit of radiology.

The measures for the management of emergency and control of

infections are explained more later in this article and are implemented in the unit of radiology during the outbreak, they have been approved by the infections control committee in the hospital. These measures will substantiate in the laws and regulations relevant to protect the patients and staff.

Team of Radiology for the management of emergency and control of infections

The director of the unit of radiology chaired the team of radiology for the management of emergency and control of infections (EMICT: Emergency Management and Infection Control Team). Its members include the assistant director, the chief technologists, chief nurse, supervisor of engineers, and the infections control nurse of the unit of radiology. The responsibilities of the team included (1) coordination between the administration of the hospital and the departments of radiology for planning for the management of infections; (2) collection of information more updated on the protection of infections to educate and train the personnel of the department; (3) redeployment of personnel according to the current situation; (4) establishment of CT procedures for patients with COVID-19; and (5) establishment of a plan for management of emergencies for the unit of radiology can operate normally.

Patients with suspected COVID-19

The suspected patients were identified in accordance with the Program of Diagnosis and Treatment of Pneumonia caused by the novel coronavirus of the NHC [4], based mainly on the epidemiological history.

Reconfiguration of the Unit of Radiology

The unit of radiology is divided into four areas [5]: contaminated areas, semi contaminated, of damping and clean. The contaminated area is connected to the 'clinic for fever' by one direct route and includes one room of examination, a team of CT and another room with DR equipment for confirmed and suspected cases. The team of CT and MRI closer to the department of emergency were appointed to examine the patients confirmed or suspected of COVID-19. There is an exclusive route to connect the contaminated area with tents. The semi-polluted area includes the rooms of control of the team of CT and MRI of the contaminated area, and other areas accessible to the other rooms of examination. Zone buffer includes areas of access to medical personal and an area for change of clothes for technologists. The clean area includes the administrative offices and rooms for observation by radiologists.

The contaminated area was isolated from the other areas using physical barriers. To guide the patients and staff, signs with directions were installed.

Protection Personnel and Training of Personnel

To provide care to patients confirmed or suspected to COVID-19, all the hospital personnel should use the equipment for protecting staff: protective medical clothing, surgical cap, N95 mask, gloves, and goggles. The process of dress and removal of the guard equipment should be done in accordance with procedures established under the supervision of the infection control nurse.

Since members of staff working in the contaminated area are under a lot of pressure, taking regular free time could help to reduce the levels of physical and mental wear out. All the technologists from the CT team of the contaminated area are granted extra 4 hours of rest time per week. In addition, the health of personnel in the contaminated area should be monitored closely for symptoms of COVID-19. The pregnant women in teams were assigned to the clean area.

The EMICT formulated and constantly updated guidelines and educates all the staff at the Hospital. The training of the EMICT for the staff of the department works mainly in the distribution of documents related to the control of infections and findings in CT of the COVID-19 cases, we have also maintained one group of the EMICT in the application system. Staff could report to the EMICT using the WeChat group at any time. Protocols for each mode and infections control manual were placed on the walls of all the rooms of examination. The EMICT requests staff to remember and periodically take measures to reduce the infection, such as using masks at all times in the unit of radiology and N95 masks if person works in the contaminated area; do not touch the mask and eyes; practice the hygiene of hands; maintain physical distance from colleagues when they are eating, drinking or talking; and do not use their cell phones while they are working.

In addition, the lead thoracic radiologist offered lectures to all the radiologists and technologists of the typical findings of COVID-19 in CT Scan, using the content developed in Wuhan, the epicenter of the outbreak in China.

Procedures of examination CT

Two sets of procedures for tomography: the procedure of CT for patients confirmed or suspected to COVID-19 and method of CT routine for those not suspected of COVID-19 were used.

CT procedure for suspected or confirmed patients with COVID-19

Before the technologist operates the computer, he or she must use equipment to protect personnel according to the standard of protection of three levels [6]. Before the CT exam of patients suspected or confirmed with COVID-19, the staff in tents or area of isolation notifies to the radiologist in advance. The technologist checks and disinfects all the equipment immediately after the examination.

The patient is moved to the waiting hall. If the patient can get on and off the CT platform, he is allowed to do it on his own. If the patient cannot get on or get off the scan couch of the tomography independently, the accompanying person must assist. Using one system of intercom, the technologist verifies the information of the patient and asks to remove any accessory metal implants in the neck and chest. This applies for both MR and CT scans [7]. It also advises the patient to hold their breath during the examination.

To scan the patient, the technologist uses one protocol of positron chest CT of low doses. After the scan, the original images are reconstructed in slices of 1 mm thickness. The technologist checks the images to ensure they comply with the standards of diagnosis and then guide the patient to move out of the room through the established area of access. The disposable sheets used during the examination are then changed for each patient. All the tools are disinfected in accordance with the procedure described further below.

To protect themselves, the technologists use N95 masks and other equipment as established by the EMICT.

CT procedure for regular patients

Some COVID-19 patients have no symptoms and may check-in the general clinic for other reasons. The CT procedure for regular patients is applicable under the following circumstances. When the patient makes an appointment for the exam, the staff asks about their epidemiological history, signs and symptoms. If the patient meets the criteria of suspicion, will be sent to the tent for fever evaluation. When

patient comes to the unit of radiology, staff takes temperature. If the temperature is above 37.2° C, the patient is sent to the tent for fever evaluation.

Those with no history of exposure, suspicious symptoms, or fever are examined with one of the uncontaminated CT kits. The technologists assigned to these teams use surgical masks. For all the patients and their companions, the use of surgical masks is required. After the CT examination, the technologist reviews the images quickly. If the images are typical of lung infection, the technologist will report immediately to the radiologist and asks for the patient to wait in the same room. If the chest radiologist suspects possible infection by COVID-19, the technologist will be immediately reported to the EMICT and sends the patient to the tents for fever checkup. The floor and the team of CT are disinfected in accordance with regulations, disinfection of the air for 30 minutes before check-in of the next patient is done. The teams of CT are considered non-contaminated after the procedures of cleaning is complete.

Procedure of examination by Digital X-ray:

The guides on the COVID-19, and the NHC does not recommend the Digital Radiography of chest due to its limited ability to diagnose COVID-19. In our hospital, we only use the mobile DR units to examine the patients critically sick who cannot be moved from their stretchers. The technologist operating the unit cell of RD uses equipment for protection personnel according to the standards of three-levels of protection and sterilizes the unit of DR according to the requirements that are described below.

Procedures for disinfection of equipment:

(Method of routine disinfection [8])

Disinfection of surface of objects: the surface of the object is cleaned with disinfectant with chlorine at a concentration of 1,000 mg /L, then two times with 75% ethanol, one time every four hours.

Disinfection of the equipment: the equipment in the area contaminated is cleaned with disinfectant with chlorine at a concentration of 2,000 mg /L. The gantry (casing) of the CT equipment and the DR machine in the contaminated area are cleaned with 75% ethanol. The equipment in the area of damping is cleaned with disinfectant with chlorine at a concentration between 500-1,000mg /L or disposable cloths of alcohol two times a day.

Disinfection of the air: All the air conditioning plants were turned off to prevent the contamination of the air. In the contaminated area: the door is opened for ventilation, at least 30 minutes, once every 4 hours. The sterilizer of air is disinfected constantly, or the beam of UV light is used for 60 minutes, 4 times of the day, remembering always close the door for inside protection during this process. The other areas are sprayed with disinfectant with chlorine at a concentration of 1,000 mg /L and ventilated two times a day.

Disinfection of the soil: the soil is cleaned with disinfectant with chlorine at a concentration of 1,000 mg /L, one time every four hours.

When there is contamination, disinfect immediately. In the case of visible pollution, absorbent disposable material must be used to eliminate the contaminants, and then use one wet cloth disinfecting with chlorine at a concentration of 2,000 mg /L for 30 minutes before drying.

Procedures of disinfection for equipment of CT of the area contaminated after the examination

In addition to the procedures already described, the table of the scanner is sterilized with disinfectant with chlorine at a concentration of 2,000 mg /L [8]. Procedures for disinfection of the equipment of CT of the area not contaminated after an examination of a case suspect with COVID-19 are routinely done as previously described and the disinfection of the air for 30 minutes is done before examination to other patients.

RESULTS

Of all these patients, 3,293 CT scans were performed. Due to reexaminations, the total number of CTs was 3,520. On average we are scanning a patient every 23.5 minutes in the contaminated areas. As a result of our precautions, any staff member of the unit of radiology developing symptoms suspected of COVID-19 is effective in avoiding

infection. The technologists who worked in the contaminated areas had the highest probability of exposure, remain negative as the test of chain reaction of the polymerase.

DISCUSSION

The response of the unit of radiology for any outbreak of infectious diseases is determined primarily by the estimated risk of infection of the staff and other patients. When the risk is low, taking precautions only for personnel in direct contact with patients may be appropriate. When the risk is high, they should take measures more stringent to limit the spread of the disease. With infectious diseases severe as the COVID-19, you must implement the highest possible measures to control infections; These include the provision of equipment, for protecting personnel training to staff and institute appropriate emergency plans.

The EMICT should consider four key areas to answer: collection of data, collaboration, assessment of needs and advice of experts [9]. The collection of data includes the distribution of more information updated on the definitions of cases and information on the tests confirmatory to all the staff who contact directly with patients to allow to take the precautions more appropriately. All the findings of typical radiological and atypical of infection should be to meet with all the radiologists to assist in the recognition of the disease and allow accurate report. We have stored images in the PACS for all the cases likely to have COVID-19 so that these images are available easily for radiologists. Also, the images from the studies previously done are available for comparison.

Collaborating with the unit of radiology of other hospitals is very important because initially the patients can visit at different centers, depending on the geographical location and distance to the hospital. If a hospital has few patients but has the information of health of patients from other hospitals, this all help to have better understanding of the radiological findings of the disease and of its epidemiology. Distribution of this information to all the health centers would lead to the early recognition of the disease and help the institution for measures of appropriate isolation.

The Internet and especially the social media applications have been used for the distribution of medical information. In addition, there are tools essential for radiologists that facilitate the instant exchange of information about the outbreaks of infectious diseases. During the first month of the outbreak, the hospital received the highest number of infected patients with the details of place where the outbreak originated.

In our opinion, the main role of chest CT is to understand the degree and evolution of COVID-19 induced lung lesions. The reasons why we adopted the protocol of positron CT of the chest of low doses are following: the CT of low doses has been used widely in the screening of cancer of the lung in early stage. As we know that early lesions in lung cancer have opacity of glass grinding (ground-glass opacity), we understand that the evaluation of COVID with low dose CT is applicable. Considering the fast development of COVID-19, many examinations by CT will be performed on the same patient to monitor the progress. An assessment of low dose CT can reduce the risk of patients associated with the radiation.

Although the processes that we established minimized the exposure of hospital personnel, personal assistant and other patients, are still limited due to the following reasons: the city is not the center of the epidemic. The number of patients with COVID-19 whom we have treated has not been high, and most of the cases are from provinces of China. However, we believe that our experience in the management, reconfiguration of our unit of radiology, and the changes implemented in the dynamics of work in the current COVID-19 situation may be useful for other units of radiology to be prepared to treat patients with COVID-19. Although no one in the department of radiology developing symptoms suspected or was confirmed with COVID-19, there is the possibility of having some staff asymptomatic.

Points to Remember

To respond to an emergency of infection in the community, a departmental team should be established especially for handling of emergency and to be able to implement procedures to control infections that can be studied by diagnostic scans of patients with suspicion of infection and prevent the spread.

Management should implement measures to control infections such as the reconfiguration of the areas of the department, staff protection and training of staff on controlling infections. Also, the standardization of procedures such as minimizing the contact for studies of thorax and the disinfection of rooms of examination should be practiced.

If there are more than one scanner in the hospital, only one should be assigned for suspected or confirmed cases.

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