Hospital Infection Prevention and Control Against COVID-19

Li Jiang, Qian Liu, Yunzhou Fan, Yan Jin, Fanjun Cheng, and Yong Gao

Contents

2.1 Regional Isolation and Management ................................................................. 18
  2.1.1 Daily Cleaning and Disinfection Process for Public Areas ............................... 18
  2.1.2 Cleaning and Disinfection System for Fever Clinic ......................................... 19
  2.1.3 Daily Cleaning and Disinfection System in Isolation Ward Area ...................... 20
  2.1.4 Terminal Disinfection System in Isolation Ward Area .................................... 22

2.2 Staff Management ..................................................................................................... 23
  2.2.1 Work Discipline of Medical Staff ....................................................................... 23
  2.2.2 Precautions for Medical Staff to Take Public Transportation During COVID-19 .... 24

2.3 Personal Protection in Different Scenes ................................................................. 24
  2.3.1 Personal Protection of Medical Staff ............................................................... 25
  2.3.2 Prevention and Treatment Process for Accidental Entry of Patients or Medical Staff Wearing Contaminated Protective Articles in the Clean Area ............................... 27
  2.3.3 Emergency Treatment Process for Occupational Exposure of Medical Staff .... 27

2.4 Biosafety Management ............................................................................................ 28

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2.1 Regional Isolation and Management

Li Jiang, Qian Liu and Yunzhou Fan

2.1.1 Daily Cleaning and Disinfection Process for Public Areas

Cleaning personnel shall wear personal protective equipment according to the regional risk level (referring to the Attachment for the division of risk areas and personal protection requirements).

Cleaning tools shall be prepared, including cleaning trolleys, rags, mops, disinfectants, measuring cups, barrels, and tidying boxes.

Disinfectant shall be prepared: Jianzhisu effervescent tablets can be prepared into 1000 mg/L available chlorine disinfectant. After preparation, disinfectant concentration test paper shall be used to monitor and record the effective concentration. Only after monitoring is qualified can the disinfectant be used. Note: Chlorine-containing disinfectants shall be ready for use, and the use time shall not exceed 24 h.

Cleaning and disinfection of areas with special infected patients and terminal disinfection shall be carried out under the guidance of professionals.

Cleaning and Disinfection of Public Areas

All public areas shall be cleaned and regularly disinfected three times a day, especially in frequent contact areas, such as all inner surfaces of elevators, seats, and registration and payment machines.

During wiping, the surface of objects shall be cleaned and disinfected in the order from clean to dirty. Wipe the relatively less contacted environmental surface first, then the frequently contacted environmental surface, and finally the floor inside the toilet and the surface of objects used. Replace a rag after wiping the surface of one object.

The ground is wiped with chlorine-containing disinfectant for the duration of 30 min.
When the surface of the object or ground is contaminated by the blood and body fluid of the patient, cleaning personnel shall wear gloves. First remove visible contamination, contaminants with moisture absorption methods (high-quality paper towel is recommended), then wipe with chlorine-containing disinfectant, and finally with clean water after 30 min.

The special elevator for specimen transportation and COVID-19 patient transfer shall be disinfected frequently, at least three times a day. Chlorine-containing disinfectant can be used to wipe the bottom and surface of the cart for 30 min, and then the air supply system can be turned on for 1 h before use of the special elevator.

Handling of Cleaning Tools After Use
Rags and mops: soak in chlorine-containing disinfectant for 30 min; clean and dry for standby.
Cleaning trolley: push it back to the disposal room after use, wipe the trolley with chlorine-containing disinfectant, and then wipe with clean water to remove the residual disinfectant for later use.

Contamination Risk Grade in Public Areas
Low-risk areas: areas where there are basically no patients, such as administrative departments, conference rooms, and medical record rooms.
Moderate-risk areas: functional examination rooms and other areas.
High-risk areas: fever clinic and isolation ward.

2.1.2 Cleaning and Disinfection System for Fever Clinic
Disposable diagnosis and treatment equipment shall be selected as far as possible, non-disposable diagnosis and treatment equipment shall be first sterilized by pressure steam, and non-heat resistant articles can be sterilized by chemical disinfectant or low-temperature sterilization equipment.

It is suggested to choose effective disinfectants such as iodophor, chlorine-containing disinfectant, and hydrogen peroxide disinfectant for hand and skin or ABHR for wiping and disinfection.

The surface of objects and ground shall be cleaned and disinfected regularly three times a day. Disinfection shall be carried out in time in case of contamination.

Ventilation (including natural ventilation and mechanical ventilation) measures can be taken to maintain indoor air circulation. Ventilation shall be conducted two to three times a day for no less than 30 min each time, or circulating air disinfecting machine shall be used for disinfection.

Ground and wall: when there are visible contaminants, the contaminants shall be completely removed before disinfection. When there is no visible contaminant, 1000 mg/L chlorine-containing disinfectant can be used to wipe or spray for disinfection. Disinfection time shall be not less than 30 min.
Surface of objects: when there are visible contaminants on the surface of diagnosis and treatment facilities and equipment, bed fences, bedside tables, furniture, door handles, and household items, the contaminants shall be completely removed before disinfection. When there are no visible contaminants, chlorine-containing disinfectant shall be used to spray, wipe, or soak for disinfection. Wipe clean with clean water after 30 min.

Treatment of contaminants (blood, secretions, vomitus, and excreta of patients): A small amount of contaminants can be carefully removed by disposable absorbent materials (such as gauze, rag) dipping with 5000–10,000 mg/L chlorine-containing disinfectant (or disinfectant wipes/dry wipes capable of achieving high-level disinfection). A large amount of contaminants shall be completely covered with disinfectant powder or bleaching powder containing water-absorbing components, or completely covered with disposable absorbent materials, and then sufficient chlorine-containing disinfectant of 5000–10,000 mg/L is poured on the absorbent materials for more than 30 min, and then carefully removed. Avoid contact with contaminants during the cleaning process. The cleaned contaminants shall be disposed of as medical wastes. Patients’ excreta, secretions, and vomitus shall be collected in special containers and soaked in chlorine-containing disinfectant of 20,000 mg/L for 2 h according to the ratio of feces to drug of 1:2. After contaminants are removed, the surface of the contaminated environmental objects shall be disinfected. Containers containing contaminants can be soaked in disinfectant containing 5000 mg/L of available chlorine for disinfection for 30 min and then cleaned.

2.1.3 Daily Cleaning and Disinfection System in Isolation Ward Area

Daily cleaning and disinfection of the ward area shall be jointly undertaken by the nursing staff and cleaning personnel of the ward area. The nursing team shall have a disinfection squad every day, specially being responsible for guiding the personal protection of cleaning personnel on duty, and assisting the cleaning personnel in jointly completing the cleaning and disinfection work on that day. The head nurse of the ward area shall be responsible for supervising and implementing the work.

Disposable diagnosis and treatment equipment shall be selected as much as possible. Non-disposable diagnosis and treatment articles shall be first sterilized by pressure steam, and non-heat resistant articles can be sterilized by chemical disinfectant or low-temperature sterilization equipment.

Preparation of Disinfectant (Use Measuring Cup)
Jianzhisu effervescent tablets (500 mg/granule): prepared into 1000 mg/L available chlorine disinfectant.

Preparation method: add 2 tablets of 500 mg/granule in 1 L water and 12 tablets in 6 L water.

After disinfectant is prepared, disinfectant concentration test paper shall be used to monitor and record the effective concentration. Only after the monitoring is
qualified can the disinfectant be used. Note: Chlorine-containing disinfectants shall be ready for use, and the use time shall not exceed 24 h.

The surface of objects and ground shall be cleaned and disinfected regularly three times a day. Disinfection shall be carried out in time in case of contamination.

**Disinfection Method**

Indoor air can be disinfected by ventilation, air disinfecting machine, or ultraviolet ray.

During wiping, the surface of objects shall be cleaned and disinfected in the order from clean to dirty ones. Use chlorine-containing disinfectant containing 1000 mg/L of available chlorine to wipe the relatively less contacted environmental surfaces first, then wipe the frequently contacted environmental surfaces, and finally wipe the floor inside the toilet and the surface of objects used. Replace a piece of rag after wiping the surface of one object, or wipe and disinfect with disposable hydrogen peroxide disinfectant wipes.

The ground is wiped with chlorine-containing disinfectant with an effect of 30 min.

When the surface of the object or ground is obviously contaminated by the blood and body fluid of the patient, cleaning personnel shall wear gloves, first remove visible contaminants with moisture absorption method (high-quality paper towel is recommended), then wipe with chlorine-containing disinfectant containing 1000 mg/L of available chlorine, and wipe with clean water after 30 min.

The empty oxygen cylinder used in the ward area shall be wiped and disinfected with chlorine-containing disinfectant or hydrogen peroxide disinfectant wipes and then transported to the designated position. The humidification bottles are recovered and then sent to the disinfection and supply center for centralized disposal.

The specimen storage box in the ward area shall be wiped with chlorine-containing disinfectant on the inner and outer surfaces three times a day.

Medical waste shall comply with the requirements of *Regulations on Medical Waste Management* and *Measures for Medical Waste Management in Medical and Health Institutions*. Double-layer yellow medical waste collection bags shall be standardized for packing. Another layer of yellow medical waste bags shall be placed on the contaminant elevator for recycling by personnel of temporary storage room.

**Handling of Cleaning Tools after Use:**

- Rags and mops: soak in disinfectant containing 1000 mg/L available chlorine for 30 min, wash, and dry for standby.
- Cleaning trolley: push it back to the disposal room after use, wipe the trolley with chlorine-containing disinfectant, and then wipe with clean water to remove the residual disinfectant for later use.
2.1.4 Terminal Disinfection System in Isolation Ward Area

Disinfection timing: terminal disinfection refers to thorough disinfection after the source of infection leaves the relevant places, such as disinfection of air, object surface, and ground in the ward after the patient is discharged from hospital, transferred to hospital or died. It shall be ensured that pathogens no longer exist in the places after terminal disinfection and various articles therein. Terminal disinfection objects include contaminants (blood waves, secretions, vomit, excretions, etc.) discharged by cases (suspected cases, confirmed cases) and infected persons (mild cases, asymptomatic infected persons) as well as articles and places that may be contaminated. It is not necessary to carry out large-scale disinfection of outdoor environment (including air). No terminal disinfection is required for places without obvious contaminants where cases and infected persons have stayed temporarily.

Disinfection process: disinfection by hydrogen peroxide sterilizer—routine wiping for cleaning and disinfection-ventilation.

Executor: medical staff on duty in the work area is responsible for terminal disinfection in the area, and the specific executor is assigned by the department.

Disinfection Method:
Close doors and windows, disinfect the air with hydrogen peroxide sterilizer, seal the room for no less than 30 min, and open the window for ventilation.

Ground and wall: when there are visible contaminants, the contaminants shall be completely removed before disinfection. When there are no visible contaminants, 1000 mg/L chlorine-containing disinfectant can be used to wipe or spray for disinfection. Disinfection time shall be not less than 30 min.

Surface of objects: when there are visible contaminants on the surface of diagnosis and treatment facilities and equipment, bed fences, bedside tables, furniture, door handles, household items, etc., the contaminants shall be completely removed before disinfection. When there are no visible contaminants, chlorine-containing disinfectant shall be used to spray, wipe, or soak for disinfection. Wipe and clean with clean water after 30 min.

Treatment of contaminants (blood, secretions, vomitus, and excreta of patients): A small amount of contaminants can be carefully removed by disposable absorbent materials (such as gauze and rag) dipping with 5000–10,000 mg/L chlorine-containing disinfectant (or disinfectant wipes/dry wipes capable of achieving high-level disinfection). A large amount of contaminants shall be completely covered with disinfectant powder or bleaching powder containing water-absorbing components, or completely covered with disposable absorbent materials, and then sufficient chlorine-containing disinfectant of 5000–10,000 mg/L is poured on the absorbent materials for more than 30 min, and then carefully removed. Avoid contact with contaminants during the cleaning process. The cleaned contaminants shall be disposed of as medical wastes. Patients’ excreta, secretions, and vomitus shall be collected in special containers and soaked in chlorine-containing disinfectant of 20,000 mg/L for 2 h according to the ratio of feces to drug of 1:2. After contaminants are removed, the surface of the contaminated environmental objects shall be disinfected. Containers containing contaminants can be soaked in disinfectant
containing 5000 mg/L of available chlorine for disinfection for 30 min and then cleaned.

Treatment of fabrics: the sheets, quilt covers, and other fabrics used by the patient shall be packaged and sealed with orange soluble packaging bags, marked, and put to the west contaminant ladder, which shall be disinfected and cleaned uniformly by the quilt and clothing warehouse, and handover records shall be made.

Medical supplies: disposable medical instruments, appliances, and articles shall be used as much as possible. After use, double-layer medical waste bags shall be sealed. According to the disposal of infectious medical waste, reusable medical instruments shall be contained in double-layer medical waste bags, labeled and put into the tidying box for centralized delivery to the disinfection and supply center for treatment.

Medical waste shall comply with the requirements of Regulations on Medical Waste Management and Measures for Medical Waste Management in Medical and Health Institutions. Double-layer yellow medical waste collection bags shall be standardized for packaging. Another layer of yellow medical waste bags shall be put to the west contaminant ladder for recycling by personnel of temporary storage room.

Personal belongings of patients: clothes of patients are recommended to be incinerated uniformly according to medical wastes. If there are no visible contaminants, circulating steam or boiling can be used for disinfection for 30 min if reuse is required; or soak in 500 mg/L chlorine-containing disinfectant for 30 min, and then clean according to the routine process; or directly put into a washing machine after being filled in a water-soluble packaging bag, and simultaneously wash and disinfect for 30 min, and keep the available chlorine content of 500 mg/L. Other personal belongings can be irradiated with ultraviolet ray for 1 h or moisture-resistant articles can be soaked in disinfectant for 30 min.

Corpse handling: after the patient dies, the movement and handling of the corpse shall be minimized, and the corpse shall be handled in a timely manner by trained staff under strict protection. Use 3000–5000 mg/L chlorine-containing disinfectant cotton ball or gauze to fill all open channels or wounds of the patient’s mouth, nose, ear, anus, tracheotomy, etc. Wrap the corpse in a double-layer cloth soaked with disinfectant and put it into a double-layer corpse bag. The civil affairs department will send a special vehicle directly to the designated place for cremation as soon as possible.

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2.2 Staff Management

Li Jiang, Qian Liu and Yunzhou Fan

### 2.2.1 Work Discipline of Medical Staff

In order to strengthen the prevention and control of COVID-19 infection in the hospital and prevent cross-infection among hospital staff, medical staff shall abide by the following work disciplines:
All staff shall truthfully report to the hospital whether they have had close contact with highly suspected or infected COVID-19 patients.

All staff shall have their body temperature monitored daily before taking up their posts and monitoring records shall be made.

Staff in each ward area shall avoid gathering for meals. The number of people eating together shall not exceed 10. The dining distance shall be kept beyond 1 m. After taking off masks, it is forbidden to talk to each other and make phone calls.

If the staffs have any discomfort symptoms, the staff shall immediately report to the person in charge of each medical team, who shall also report to the infection department and the public health department of the hospital.

Except for the on-duty staff, other staff must leave the ward area as soon as possible and are not allowed to stay in the ward area and cleaning area.

Infection prevention and control personnel of each medical team in the hospital need to strengthen supervision and training of infection prevention and control measures of this medical team and personal protective measures of medical team members, and correct problems found instantly.

### 2.2.2 Precautions for Medical Staff to Take Public Transportation During COVID-19

Before taking public vehicles, wear surgical masks or medical protective masks regularly, and carry out daily self-health monitoring.

Do not eat or drink when taking public vehicles.

When taking public vehicles keep the distance with others as far as possible and reduce the conversation; try to be in a single row and single seat, and reduce touching the articles in the vehicle.

When taking public vehicles, open the windows as much as possible to keep the air in the vehicle flowing.

When taking public vehicles, medical staff shall carry ABHR with them, and carry out hand hygiene in time after touching frequently contacted surfaces (such as vehicle handles and window keys).

Medical staff shall record the time and license plate number of daily public vehicle so as to carry out epidemiological investigation when necessary.

If the medical staff feel unwell, suspected, or confirmed to be infected with novel coronavirus, they need to timely and truthfully report the date, time, and license plate number of the public vehicle taken and assist in the epidemiological investigation of close contacts.

If taking online taxi-hailing service, try not to share it with many people, and choose the rear seat when taking it.

### 2.3 Personal Protection in Different Scenes

Li Jiang, Qian Liu and Yunzhou Fan
2.3.1 Personal Protection of Medical Staff

2.3.1.1 Personal Protective Equipment and Application
Personal protective equipment shall be used by all personnel who come into contact with or may come into contact with COVID-19 cases and infected persons, contaminants (blood, body fluids, secretions, vomitus and excrement, etc.) and their contaminated articles or environmental surfaces, including:

2.3.1.1.1 Gloves
When entering contaminated areas or carrying out diagnosis and treatment operations, wear disposable rubber or nitrile gloves according to the work content, disinfect in time when contacting different patients or gloves are damaged, and replace gloves and carry out hand hygiene.

2.3.1.1.2 Medical Protective Mask
When entering contaminated areas or carrying out diagnosis and treatment operations, medical protective masks (N95 and above) or powered air-purifying respirators shall be worn. Air tightness inspection shall be carried out before each wearing. When wearing multiple protective articles, it is ensured that the medical protective masks are finally removed.

2.3.1.1.3 Protective Face Shield or Goggles
When entering contaminated areas or carrying out diagnosis and treatment operations, if the eyes, conjunctiva, and face are at risk of being contaminated by blood, body fluids, secretions, excretions, and aerosols, protective face shields or goggles shall be worn. After each use of reusable goggles, disinfection and drying shall be carried out in time for standby.

2.3.1.1.4 Medical Disposable Protective Suit
When entering contaminated areas or carrying out diagnosis and treatment operations, personal clothes shall be replaced and work clothes (scrubs or disposable clothes) shall be worn and then medical disposable protective suit shall be worn.

2.3.1.2 Hand Hygiene
When there are no obvious contaminants, ABHR shall be used. When there are visible contaminants, hand sanitizer shall be used to wash hands under flowing water, and then ABHR shall be used.

Hand hygiene measures shall be strictly taken in daily work, especially before wearing gloves and personal protective equipment. Before sterile operation for patients, after possible contact with patients’ blood, body fluids, and their contaminated articles or contaminated environmental surfaces, and in the process of removing personal protective equipment, special attention shall be paid to hand hygiene measures.
2.3.1.3 Personal Protection for Specific Groups

2.3.1.3.1 Staff in Isolation Ward Area and Staff in Medical Observation Place
It is recommended to wear work clothes, disposable work caps, disposable gloves, disposable medical protective suit, medical protective masks (N95 and above), protective face shields or goggles, work shoes or rubber boots, waterproof boot covers, etc.

2.3.1.3.2 Personnel Transferring Infected Persons
It is recommended to wear work clothes, disposable work caps, disposable gloves, disposable medical protective suit, medical protective masks (N95 and above), protective face shields or goggles, work shoes or rubber boots, waterproof boot covers, etc.

2.3.1.3.3 Personnel Handling Corpse
It is recommended to wear work clothes, disposable work caps, disposable gloves and long-sleeved padded rubber gloves, disposable medical protective suit, medical protective masks (N95 and above), protective face shields, work shoes or rubber boots, waterproof boot covers, waterproof aprons, or waterproof isolation gown, etc.

2.3.1.3.4 Personnel for Environmental Cleaning and Disinfection
It is recommended to wear work clothes, disposable work caps, disposable gloves and long-sleeved padded rubber gloves, disposable medical protective suit, medical protective masks (N95 and above), protective face shields, work shoes or rubber boots, waterproof boot covers, waterproof aprons, or waterproof isolation gown.

2.3.1.3.5 Personnel Collecting Specimens
It is recommended to wear work clothes, disposable work caps, double-layer gloves, disposable medical protective suit, medical protective masks (N95 and above), protective face shields, work shoes or rubber boots, and waterproof boot covers. When necessary, waterproof aprons or waterproof isolation gown can be worn.

2.3.1.3.6 Laboratory Staff
It is recommended to at least wear work clothes, disposable work caps, double-layer gloves, disposable medical protective suit, medical protective masks (N95 and above), protective face shields or goggles, work shoes or rubber boots, and waterproof boot covers. When necessary, waterproof aprons or waterproof isolation gown can be worn.

2.3.1.4 Precautions for Removing Protective Equipment
Contact with the contaminated surface as little as possible when removing.
Non-disposable items such as the removed protective goggles and rubber boots shall be put into a container filled with disinfectant for soaking. The remaining
disposable items shall be put into yellow medical waste collection bags for centralized disposal as medical waste.

Hand disinfection shall be carried out in each step of removing protective equipment. Hand washing and hand disinfection shall be carried out again after all protective equipment has been removed.

2.3.2 Prevention and Treatment Process for Accidental Entry of Patients or Medical Staff Wearing Contaminated Protective Articles in the Clean Area

Access control systems are installed on the medical staff passage and the patient passage.

When patients are admitted to the hospital, they will be sent to the patient passage in the isolation ward area by special personnel.

Improve the education of patients, and inform the patients at the time of admission and post-admission: for your safety, please limit your activities within this ward.

Strengthen territorial management. The head nurse of the isolation ward is responsible for on-site training and assessment of medical staff who rotate into the area to work, and medical staff will take up their posts after passing the assessment.

Put up clear and eye-catching warnings at the entrances of different areas.

When patients or medical staff wearing contaminated protective articles enter the clean area:

1. Immediately direct them to return from the buffer zone to the contaminated zone.
2. Open the window and ventilate immediately.
3. When there are visible contaminants on the surface of environmental objects and ground, first use disposable absorbent materials (such as gauze, cloth) to dip 5000 mg/L chlorine-containing disinfectant to carefully remove contaminants. When there is no visible contaminant, 1000 mg/L chlorine-containing disinfectant can be used to wipe and disinfect.
4. If there are no people, ultraviolet lamp can be used to irradiate for 1 h or hydrogen peroxide air sterilizer can be used; if there is someone, mobile plasma air sterilizer can be used for air disinfection.

2.3.3 Emergency Treatment Process for Occupational Exposure of Medical Staff

During the epidemic of COVID-19, if medical staff are exposed to occupational hazards in the contaminated area of the isolation ward, they should go to the nearest location where there are hand hygiene facilities of flowing water to carry out emergency treatment on the exposed areas, and take off protective articles at the designated locations according to the process, and then carry out further exposure treatment in the clean area and report to the superior.
When the skin is contaminated by contaminants, the contaminants shall be removed immediately, and then 0.5% iodophor or 3% hydrogen peroxide disinfectant shall be dipped in disposable absorbent material to wipe and disinfect for more than 3 min, and then clear water is used to clean.

When mucosa of eyes is contaminated by contaminants, a large amount of normal saline or 0.05% iodophor shall be used for flushing and disinfection.

Immediately after occupational exposure of sharp instruments such as needle prick injuries, gently squeeze the blood from the proximal end to the distal end of the wound as far as possible, rinse with soap solution and flowing water, and then disinfect with 75% alcohol or 0.5% iodophor, and cover up the wound.

After respiratory tract exposure, gargle with a large amount of normal saline or hydrogen peroxide, and assess whether medical observation is needed according to the exposure. Those needing medical observation are required to stay at home for 14 days. If respiratory tract symptoms occur during observation, go to a fever clinic immediately.

Occupational exposure can be prevented by taking appropriate antiviral drugs under the guidance of physicians of the infection department.

2.4 Biosafety Management

Li Jiang, Qian Liu and Yunzhou Fan

2.4.1 Infection Prevention and Control for Novel Coronavirus Specimen Collection and Transportation [1–3]

2.4.1.1 Protection of Sampling Personnel
Wear disposable work caps, medical protective masks (N95 and above) or powered air-purifying respirators, protective face shields, protective inner clothes or work clothes (white coats), disposable medical protective suit, disposable latex gloves (2 pairs), work shoes, and waterproof boot covers.

2.4.1.2 Requirements for Sampling Rooms in Fever Clinic
1. Special sampling rooms shall be set up instead of bedside sampling.
2. The sampling room shall be equipped with air disinfection devices such as ultraviolet ray/air disinfecting machine.
3. During sampling, the number of personnel shall be minimized in the collection room except the sampling personnel and the patient to be sampled.
4. After sampling, air and object surface disinfection shall be carried out before sampling for the next patient.
5. Personnel carrying out cleaning and disinfection shall also make personal protection.
2.4.1.3 Placement of Specimens
1. All specimens shall be placed in a suitable size of sample collection tube with spiral cover, gasket, and freeze resistance, and fastened.
2. Put the sealed specimen into biosafety sample bags, one specimen in each bag.
3. Spray the biosafety sample bag with 75% alcohol and then place it in the designated place.

2.4.1.4 Occupational Protection of Specimen Transporting Personnel
1. Wear disposable work caps, protective face shields or goggles (anti-fog type), medical protective mask (N95 and above), protective inner clothes or work clothes, disposable anti-infiltration isolation gown/disposable protective suit (as the case may be), disposable latex gloves (double-layer), and disposable shoe covers if necessary.
2. Carry hand sanitizer at all times.

2.4.1.5 Specimen Transportation
1. Specimen transporting personnel shall follow a fixed route and a designated elevator to collect and transport specimens at a designated place.
2. Hand hygiene shall be carried out after each biosafety sample bag is put into the transporting container.
3. Transporting containers shall be sealed and have biohazard identification.
4. After transporting the specimen, the transporting container shall be disinfected and can be soaked with 1000 mg/L chlorine-containing disinfectant for 30 min for disinfection.
5. Designated specimen transporting elevators shall be disinfected daily. Chlorine-containing disinfectant can be used to wipe the cart bottom and cart surface for 30 min, and then the air supply system shall be turned on for 1 h before use of the elevators.

2.5 Patient Transfer

Yan Jin and Fanjun Cheng

When a non-designated medical institution finds a confirmed or suspected COVID-19 patient, a report is necessary to the local health administrative department. The patient shall be transferred to the isolation treatment place or the isolation ward of the designated hospital according to the classification. For medical institutions with isolation wards, the clinic will receive the patient and send them to isolation wards. There are two major types of patient transfer: inter-hospital transfer, from clinic or ward of general medical institutions and clinic or ward of designated hospitals of fever clinic to designated hospitals for critical cases because of critical illness, and in-hospital transfer, from designated hospitals and/or critical case
treatment hospitals to places other than the ward area for workup or treatment. Transfer elements include transfer-involved staff, patients, and transfer tools. Commonly used transfer tools include emergency ambulances, transfer rollaway beds, and wheelchairs.

2.5.1 Inter-hospital Transfer, i.e., Transfer Between Medical Institutions

The health administrative department, the first-aid center, the out-transferring organization, and the transfer-in organization jointly set up a transfer working team. Members of the team shall fully understand the patient’s condition.

- Determine the transfer time and route.
- Prepare transfer vehicles and on-board equipment.
- Configure special vehicles and equipment, and set up special parking and decontamination areas. Negative pressure isolation cabin or negative pressure ambulance shall be used for transfer as much as possible [4]. When transferring severe cases, the vehicle shall be equipped with necessary life support equipment.

The cab is strictly sealed and isolated from the carriage, and the vehicle is equipped with placement area for contaminated articles, protective articles, disinfectant, and ABHR.

- Preparation of transfer staff.
  - Medical staff shall implement the Level 3 protection standard [5]. Drivers shall implement the Level 2 protection standard.
  - After transferring COVID-19 patients, replace the full set of protective articles in time.

- Patient preparation. Communicate with patients in advance and make preparations for their psychology and personal belongings. When multiple patients are transferred, arrange the sequence of transfer.

2.5.1.1 Transfer Workflow [6]

The staff receive the transfer order → wear protective articles → drive to the corresponding medical institutions according to the order → hand over the patient at the designated place → guide the patient to wear surgical masks → place the patient in an ambulance → give symptomatic treatment according to the patient’s condition → transfer the patient to the receiving medical institution and hand over → the transfer vehicle and the staff return to the working place → the staff and the vehicle are disinfected → the staff and the vehicle are on a standby.

2.5.2 In-hospital Transfer

From the fever clinic to the isolation ward, the transfer mode and details are determined according to the patient’s condition.

- Determine the receiving and treatment area and time in advance.
Mild cases and ordinary patients arrive at the receiving and treatment area according to the designated route under the guidance of hospital staff.

For severe and critical patients, the transfer will be started after the patient’s condition is evaluated by both the transfer-out department and the transfer-in department.

The transfer-out department and the receiving department shall agree in advance on the transfer time and the in-hospital route.

The receiving department shall prepare for receiving and treatment according to the patient’s condition and provide adequate corresponding treatment equipment and medicine.

Preparation of transfer-out department for transfer objects:

For high-risk patients, choose and prepare necessary vital sign monitoring and supporting equipment, rebreathing bags, 5 L portable oxygen cylinder, portable ventilator, multifunctional ECG monitor, oxygen saturation monitor, and other equipment related to illness, as well as prepare first-aid kit when necessary.

Preparation of transfer elevator: the transfer-out department shall contact the elevator operator in advance to ensure the use of the special elevator.

The transfer-out department shall determine the transfer personnel and specify the division of labor.

Patient preparation: reevaluate the condition before departure, and check various pipelines to ensure proper fixation and functional status.

After the above preparations have been confirmed in place, the transfer will begin.

Transfer personnel and patients shall follow the established route.

Observation of disease condition and handling of emergencies shall be carried out during transfer.

Arrival of transfer: after properly arranging the patient, both parties jointly evaluate the patient, and hand over the patient’s condition and accompanying materials before the transfer personnel return to the department.

2.5.3 Patients Who Need to Be Transferred in Hospital Due to Special Examinations

Those that need CT workup during their stay in hospital:

The CT application is issued by the doctor in charge, and the nurse is responsible for contacting the CT room.

The CT room arranges the examination time of patients in hospital as a whole according to the reservation status in hospital and notifies the patient’s department.

The nurse informs the accompanying staff and the patient is guided and assisted by the accompanying staff to the CT room.

After the examination, the accompanying staff sends the patient back to the department where the patient is located for handover with the nurse.

Those that need emergency interventional operation:

If confirmed and suspected patients in the fever clinic are determined that emergency interventional operation is required, the fever clinic shall immediately report
to the medical department, and the intervention department shall prepare for receiving.

The patient is accompanied by the receiving doctors and nurses, and transported to the interventional operating room through special passages and elevators.

The patient is introduced into the isolation operation room by the staff in the interventional operating room.

For patients who need to be admitted to corresponding specialized wards after surgery, the staff shall refer to the regulations for transferring severe and critical patients.

For those requiring emergency operation during hospital stay, the disposal process shall be implemented according to the regulations for transferring patients undergoing emergency interventional operation.

Transfer under other special circumstances. During the treatment of COVID-19 patients, in order to minimize the possibility of nosocomial infection during patient transfer, we try to establish a transfer route with less distance and shorter time for medical staff and patients.

Abandon the conventional ultrasound examination. Ultrasound examination instruments shall be placed at fixed points in isolation ward areas and fever clinics, and bedside portable ultrasound equipment shall be fully used to reduce patient flow.

In the fever clinic, a mobile CT cabin is arranged at a fixed point, so that patients in the fever clinic can enter the examination area after walking out of the treatment area, thus reducing the walking distance.

Enrich the logistics transfer channel staff to provide support for safe and convenient transfer.

2.6 Digital Support for Epidemic Prevention and Control

Yong Gao

2.6.1 Vigorously Carry out Internet Diagnosis and Treatment to Deal with the Epidemic

Online diagnosis and treatment: Online medical treatment has played an important role in the epidemic (online clinic service, fever consultation, offline drug distribution, etc.). On January 24, online fever consultation was added to the online consultation in Wuhan Union Hospital of China. The consultation case number has reached more than 70,000. On one hand, during the epidemic prevention and control period, all kinds of medical treatment groups have huge urgent medical needs, such as consultation, chronic diseases, and other non-emergency medical needs, which can be relieved through online hospitals. On the other hand, diagnosis and treatment through the Internet can significantly reduce the flow of people in hospitals and reduce the risk of cross-infection of patients. There are two obvious trends in Internet medical treatment. First, as an emergency measure in a special period, online clinic service has become the first choice for various hospitals. Hospitals are
accelerating online services and user habits are gradually forming. Competent departments including the National Health Commission and the National Healthcare Security Administration also recognize the value of Internet hospitals and have incorporated online diagnosis and treatment items into medical insurance. Second, in the medium and long term, in addition to fever consultation, there is also a demand for many routine chronic disease consultations. Hospital Internet online processes will merge with offline processes. After the epidemic, users’ experience of Internet consultation will be further enhanced and the connection between online and offline will be promoted. In the future, there will be a trend to build Internet hospitals by hospitals above Grade II nationwide after the epidemic. More online diagnosis and treatment items will also be included in medical insurance.

Internet hospitals provide services such as appointment registration, inquiry, and follow-up after diagnosis and subsequent visit. For patients who must go to the hospital, necessary guidance such as treatment process, transportation, parking, arrival time, protective measures, triage information, and indoor navigation will be intelligently provided, and comprehensive data collection of patients will be completed online in advance to improve diagnosis and treatment efficiency and reduce the hospital stay time.

The clinic electronic information system will promote paperless examination, appointment, and prescription, guide patients to make full use of online payment, and reduce the risk of cross-infection caused by handling paper documents.

2.6.2 Reduce Work Intensity and Infection Risk of Medical Staff

Online consultation enables doctors to provide the best solution for various medical needs without visiting the clinic.

Smart terminals such as smart phones can be used to realize mobile ward rounds and remote ward rounds, reduce unnecessary exposure risks of medical staff, reduce doctors’ work intensity, and save protective materials.

2.6.3 Teleconference, Consultation, and Training System

Informatization helps to construct the intelligent remote training, conference, consultation, and disease discussion platform. Traditional disease discussions, meetings, and training need people to be gathered. It is necessary to improve the level of understanding and diagnosis and treatment capability through centralized study, discussion, and warning. However, the high contagiousness of COVID-19 requires that large-scale gathering shall be avoided as much as possible in the hospital. How can this contradiction be solved? The West Campus of Wuhan Union Hospital of China actively coordinates information providers such as Huawei, China Unicom, and XY Link to open 21 sets of remote information terminals in the hospital to realize interconnection and intercommunication among all departments, different manufacturers, and various conference rooms. It not only enables medical teams to communicate with headquarters thousands of miles away and obtain strong
technical support, but also realizes simultaneous case discussion and training in different spaces of the whole hospital, including departments, residence, and home, greatly improving the participation effect of various training and discussions.

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