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# CSC Expert Consensus on Principles of Clinical Management of Patients with Severe Emergent Cardiovascular Diseases during the COVID-19 Epidemic

**Running Title:** *Han et al.; Consensus on Managing CVD during COVID-19 Epidemic*

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**Abstract**

In response to the outbreak of coronavirus disease 2019 (COVID-19) in Wuhan, China, the Chinese Society of Cardiology (CSC) issued this consensus statement after consulting with 125 medical experts in the fields of cardiovascular disease and infectious disease. The over-arching principles laid out here are the following: 1) Consider the prevention and control of COVID-19 transmission as the highest priority, including self-protection of medical staff; 2) Patient risk assessment of both infection and cardiovascular issues. Where appropriate, preferential use of conservative medical therapeutic approaches to minimize disease spread; 3) At all times, medical practices and interventional procedures should be conducted in accordance with the directives of the infection control department of local hospitals and local health commissions.

**Key Words:** Coronavirus disease; cardiovascular disease; disease management;consensus

**Nonstandard Abbreviations and Acronyms.**

| | |
|---|---|
| COVID-19 | Coronavirus Disease 2019 |
| CSC | Chinese Society of Cardiology |
| CTA | Computed Tomography Angiography |
| GRACE | Global Registry of Acute Coronary Events |
| NSTE-ACS | Non-ST segment Elevation Acute Coronary Syndromes |
| STEMI | ST-segment Elevation Myocardial Infarction |

The coronavirus disease 2019 (COVID-19) outbreak in China commenced in Wuhan in December, 2019. The virus spread rapidly due to its robust capacity for human-to-human transmission, long incubation period, and asymptomatic infection characteristics. In the early stages of the outbreak, it was inferred that the nosocomial infection rate could reach 41% without rapid intervention [1]. On January 20, 2020, the Chinese National Health Commission announced that COVID-19 had been included in the list of Class B infectious diseases categorized by the Chinese Law on the Prevention and Control of Infectious Diseases, and should be managed as a Class A infectious disease (for categorization and management principles of infectious diseases, please see Supplemental material I). Strict quarantine measures have been undertaken in Hubei province and other regions of China.

The outbreak emerged in the winter and spring, seasons marked by high incidence of cardiovascular disease presentations. Therefore, the outbreak impacted the treatment of patients with emerging cardiovascular events: (1) Due to quarantine restrictions and overloaded public emergency systems, delays emerged between the onset of symptoms and medical consultation; (2) Due to the need for epidemic control, over-stretched medical staff in the Emergency Department struggled to provide timely diagnostic and treatment options; (3) Patients with suspected or confirmed COVID-19 were appropriately treated conservatively (*i.e.* with medicine) to avoid and limit nosocomial transmission.

To heighten awareness of, and capabilities for, self-protection among cardiovascular medical staff, avoid nosocomial infection, and improve treatment efficiency of cardiovascular diseases during the prevention and control periods of the COVID-19 epidemic, the “CSC Expert

Consensus on Principles of Clinical Management of Patients with Severe Emergent Cardiovascular Diseases during the COVID-19 Epidemic" was developed by 125 experts, including cardiologists mainly from 8 Academic Groups (macrovascular, cardiovascular critical care, interventional cardiology, atherosclerosis and coronary heart disease, intracoronary imaging and physiology, pulmonary vascular disease, youth and nursing) of the Chinese Society of Cardiology (CSC) and infectious disease specialists. Among them, 23 experts are currently working in Wuhan. This consensus statement will be updated periodically going forward in conjunction with the release of the new edition of the Chinese Clinical Guideline for COVID-19 Diagnosis and Treatment issued by the National Health Commission of China.



**I. Triage of patients in the Emergency Department with severe emergent cardiovascular diseases [2]**



All COVID-19 patients (confirmed and suspected) should be treated in hospitals designated by the local government in accordance with guidelines of the National Health Commission.

All patients with severe emergent cardiovascular diseases complicated by fever should be first evaluated in the fever clinic of the local hospital, and transferred to the COVID-19-designated hospital for further treatment as quickly as possible after being confirmed virus positive.

In areas outside Hubei Province, patients with severe emergent cardiovascular diseases who have tested negative for COVID-19 (no epidemiological history, no fever, no respiratory symptoms, no fatigue or gastrointestinal symptoms, and negative lung CT scan) can be treated in a COVID-19-designated or non-designated hospital, and admitted to the cardiology care unit per

standard protocols.

For patients in whom COVID-19 has not been ruled out temporarily (in areas outside Hubei Province, without epidemiological history of COVID-19, with 1-2 clinical manifestations of COVID-19, but not fulfilling diagnostic criteria for COVID-19), medical management should comply with guidance from a COVID-19 expert panel in the hospital, as well as senior hospital administrative leadership. This includes quarantine in a single-bed room (initiating second grade protection[3]) (For details of protection grade for medical staff, please see **Supplemental Figure 1**), close monitoring for changes in clinical manifestations, lung CT imaging, and COVID-19 nucleic acid testing as soon as possible.

The Chinese Clinical Guideline for COVID-19 Diagnosis and Treatment (5th edition) [4] added diagnostic imaging features of pneumonia to the clinical diagnostic criteria for suspected cases in Hubei Province. Considering that some asymptomatic patients may be a source of infection and transmission, all patients with severe emergent cardiovascular diseases should be managed as suspected cases of COVID-19 in Hubei Province.

**II. Recommended principles of clinical treatment of patients with severe emergent cardiovascular diseases during the epidemic**

**(I) General principles**

During the epidemic, the over-arching principles of treatment should be the following: Epidemic control as the first priority, prompt risk assessment, preference for conservative medical therapy, and strict measures to limit infection spread within the hospital and to healthcare workers.

1. Risk assessment

The purpose of risk assessment is to carefully weigh the relative advantages and disadvantages of treating cardiovascular disease all while preventing the risk of SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) transmission. During the period of epidemic, under the premise of minimizing the risk of virus transmission, all efforts might be taken to treat patients with severe emergent cardiovascular diseases in a timely manner.

During the epidemic, patients should be evaluated for the following: (1) COVID-19, confirmed or suspected; (2) the benefits of treatment for severe emergent cardiovascular diseases; (3) comprehensive consideration of a differential diagnosis (dyspnea, decreased oxygen saturation and shock caused by cardiovascular diseases versus critical COVID-19 infection). Vigilance should be paid to avoid misdiagnosing patients with pulmonary infarction as COVID-19 pneumonia.

2. Protection for patients and medical staff

On the basis of the Chinese Law on the Prevention and Control of Infectious Diseases, as well as regulations regarding nosocomial infection control issued by the National Health Commission, interpreted in the light of the unique characteristics of the COVID-19 epidemic [5-8], protective quarantine measures should be adhered to strictly throughout the process of treatment in all patients, including those with severe emergent cardiovascular diseases, so as to minimize the risk of disease transmission across patients and medical staff.

3. Adapting measures tailored to specific local epidemic situations

Strategy selection for the treatment of severe emergent cardiovascular diseases should be based on the specific features of the epidemic across different regions of China (**Figures 1 and**

**2**).

4. Consider conservative medical treatment as a top priority

During the epidemic, an optimized medical therapy strategy should be prioritized for patients with severe emergent cardiovascular diseases who cannot be ruled out for COVID-19 in order to limit nosocomial infection.

**(II) Medical therapy**

During the COVID-19 pandemic, high-risk patients with severe emergent cardiovascular diseases (listed in **Table 1**) should be admitted to the hospital and receive optimized, goal-directed medical therapy according to recent guidelines in order to alleviate symptoms and position the patient for an optimal clinical outcome [9-14].

**(III) Strategy of cardiovascular intervention**

During the COVID-19 pandemic, it is recommended that cardiovascular departments in all hospitals develop a plan for emergency response, according to the unique aspects of each region and institution. The decision to pursue an invasive strategy of diagnosis and/or therapy should be considered with caution.

1. Conditions warranting invasive intervention

For suspected/confirmed patients for whom emergency intervention or surgical procedure is required, we recommend that all the following conditions be met, assuming failure of optimized, goal-directed, medical therapy: (1) one of the emergencies (listed in **Table 2**) is present; (2) taking place in a hospital designated for COVID-19; (3) intervening in a cardiac catheterization lab (or operating room) with negative-pressure ventilation followed by strict peri-procedural

disinfection; (4) third-grade protection is adopted [3] (For details of protection grade for medical staff, please see **Supplemental Figure 1**); (5) approval by the local health commission.

For patients who cannot be ruled out for COVID-19 infection temporarily in a region with a low incidence of COVID-19, all the following conditions should be met: (1) one of the emergencies (listed in Table 2) is present; (2) obtain consent from a COVID-19 expert panel or health administrative supervisors; (3) intervene in a uniquely equipped cardiac catheterization/electrophysiology laboratory (or operating room) specifically engineered with more than standard disinfection procedures that fulfill regulatory mandates for infection control; central air conditioning (*e.g.* laminar flow and ventilation) must be stopped if negative-pressure ventilation is not available; (4) adopt second- or third-grade protection.[3]

2. In-hospital transport of patients undergoing interventional procedures

All suspected and confirmed COVID-19 patients should be transported with standardized attention to relevant national regulations [6]. Prior to the procedure, the transfer route should be laid out and protection during transfer should be guaranteed. Special-purpose elevators should be identified and utilized. Delays during the in-hospital transfer process should be minimized, and transfers between departments simplified, avoiding frequent transfers to reduce the risk of infection transmission.

3. Protection in cardiac catheterization labs

For patients with confirmed or suspected COVID-19 undergoing emergent cardiovascular interventional procedures, pre-established plans for COVID-19 or other infectious disease should be initiated. This should include all aspects of preoperative preparation and comprehensive

peri-operative management of the patients, operators, environment, disinfection/sterilization, emergency supplies, equipment, and consumables [5-8, 15].

Cardiovascular interventional procedures should be conducted in cardiac catheterization labs equipped with negative-pressure ventilation (for suspected or confirmed COVID-19 patients, medical staff should adopt third-grade protection) or special separate catheterization labs (for patients not yet ruled out for COVID-19 in regions with a low incidence of COVID-19, medical staff should adopt second- or third-grade protection). Strict quarantine and protection measures should be enforced throughout the entire process in accordance with relevant regulations of the National Health Commission.

Terminal disinfection of the catheterization lab should be enforced according to the characteristics of COVID-19. At present, it is known that ultraviolet light, exposure to 56°C for 30 min, as well as lipid solvents, such as diethyl ether, 75% ethanol, chlorine-containing disinfectants, peracetic acid, and chloroform can all effectively inactivate COVID-19. Chlorhexidine is ineffective [4].

Following a procedure in a patient who has not been ruled out for COVID-19 infection, the catheterization lab should be disinfected according to standards issued by the National Health Commission [16]. The main requirements include: hydrogen peroxide (3%) spray should be used for air disinfection after the operation, and instruments should be cleaned with 2000 mg/L chlorine-containing disinfecting solution. After 30 minutes, clean water should be used to wipe off the instruments. If there is blood or secretion contamination on the floor, wall, and other surface, the contaminating material should be completely removed before spraying, wiping or

soaking as above. The remaining floor and wall (1.5 m from the floor and below) should be wiped with 2000 mg/L chlorinated disinfectant solution, and sprayed with 3% hydrogen peroxide again if necessary (or sterilized with an air disinfection machine). After disinfection, the department of nosocomial infections should be consulted prior to re-use.

4. Perioperative management

Patients diagnosed with COVID-19 should be transferred to an ICU with negative-pressure ventilation for continued treatment during the epidemic. Suspected COVID-19 patients should be isolated in a single-bed room, and suspected infectious specimens should be handled with care. A definitive diagnosis should be made as soon as possible. Perioperative management of confirmed and suspected COVID-19 patients should include the following: (1) COVID-19-related monitoring and treatment; (2) acute and/or critical cardiovascular disease-related monitoring and management.





**III. Other recommendations**

**(I) Optimization of laboratory testing**

It is recommended to select laboratory tests with definitive sensitivity and specificity for disease diagnosis or assessment, and minimize the frequency of transferring cardiovascular patients across departments to limit cross-infection.

Recommendations for testing:

For patients with acute aortic syndrome or acute pulmonary embolism, CT angiography (CTA) is preferred. For patients suspected of acute pulmonary embolism, D-dimer testing and deep vein ultrasound in the lower extremity should be carried out. For patients with acute

coronary syndrome, ordinary ECG and standard biomarkers for cardiac injury are preferred. If cardiac mechanical complications are suspected, bedside echocardiography may be considered.

It is recommended that all patients should undergo lung CT examination to evaluate for imaging features typical of COVID-19. The parameters of CT scan and associated disinfection and quarantine measures should adhere to the recently released consensus [17]. Chest X-ray is not recommended because of a high rate of false negative diagnosis.

**(II) Referral between hospitals**

In principle, patients with severe emergent cardiovascular diseases who have been ruled out for COVID-19 should be treated locally. Confirmed or suspected COVID-19 patients with critical cardiovascular diseases should be transferred immediately to a local COVID-19-designated hospital for quarantine and treatment. The referral should be carried out in accordance with the "Working Plan for the Transfer of COVID-19 Patients (Interim)" released by the National Health Commission [18]. Before initiating the referral, it is necessary to evaluate all the relevant implications, including the possible impact of epidemic-related delays in patient treatment, and fully weigh the advantages and disadvantages of referral. Communication with the referral hospital and department in advance is essential to minimize delays in transport.

**(III) Telemedicine**

Whenever possible, it is recommended to employ telemedicine strategies to optimize the prevention and treatment of patients with severe emergent cardiovascular diseases during the epidemic. The main benefits of telemedicine include: (1) guiding the treatment of patients in primary hospitals to minimize the risk of disease transmission during referral; (2) continuing to

provide optimal treatment to the patients with cardiovascular disease who are isolated at home or discharged from the hospital to prevent clinical deterioration; (3) guiding patients with onset of cardiovascular emergencies at home to the nearest medical facility; (4) reducing unnecessary visits to the hospital to decrease the incidence of cluster infections.

**(IV) Psychological intervention**

According to the Guidelines on emergency psychological crisis intervention for COVID-19 issued by National Health commission [19], it is recommended to evaluate a patient's mental health, and provide mental health education as well as psychological crisis intervention, including the following:

(1) When appropriate, delivering positive information may help to increase the patient's confidence to defeat COVID-19.

(2) Addressing negative emotions and working with patients' families to identify ways to preserve social contact.

(3) Carrying out early rehabilitation.

(4) Seeking help from psychologists for crisis intervention when deemed necessary.

(5) Recognizing depression or anxiety-induced chest discomfort, and consulting psychiatrists if necessary.

**IV. Conclusions**

The COVID-19 outbreak has substantially increased the difficulty of treating patients with severe emergent cardiovascular diseases. The possibility of direct COVID-19-inflicted damage to the cardiovascular system, psychological stress on patients and care providers, and infection-induced

myocardial hypoxia may all contribute to the exacerbation of cardiovascular diseases. At all times, attention to prevention and control of infectious diseases in China is paramount. Individualized diagnosis and treatment measures tailored to specific local epidemic situations should be developed. As we learn more about this virus and its impact on cardiovascular diseases, additional recommendations will be forthcoming.

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**Table 1.** Patients with severe emergent cardiovascular diseases for whom hospitalization and conservative medical treatment is recommended during COVID-19 epidemic.

| Patients with severe emergent cardiovascular diseases |
|---|
| 1. Patients with STEMI for whom thrombolytic therapy is indicated[*]. |
| 2. STEMI patients presenting after exceeding the optimal window of time for revascularization but yet with worsen symptoms, such as severe chest pain, continuous ST-segment elevation, or myocardial infarction-related mechanical complications. |
| 3. High risk NSTE-ACS patients (GRACE score ≥ 140). |
| 4. Patients with uncomplicated Stanford type B aortic dissection[#]. |
| 5. Patients with acute pulmonary embolism. |
| 6. Patients with acute exacerbation of heart failure. |
| 7. Patients with hypertensive emergency. |

STEMI, ST-segment elevation myocardial infarction; NSTE-ACS, non-ST elevation acute coronary syndromes; GRACE, Global Registry of Acute Coronary Events.
[*]The third- generation thrombolytic agents are preferred.
[#]For Stanford type A aortic dissection, surgical treatment is recommended.

**Table 2.** Severe cardiovascular diseases requiring urgent or emergent intervention or surgery.

| Patients with severe cardiovascular diseases |
|---|
| 1. Acute STEMI with hemodynamic instability. |
| 2. Life-threatening NSTEMI indicated for urgent revascularization. |
| 3. Stanford type A or complex Type B acute aortic dissection. |
| 4. Bradyarrhythmia complicated with syncope or unstable hemodynamics mandating implantation of a temporary (bedside implantation as far as possible), or, if indicated, permanent pacemaker. |
| 5. Pulmonary embolism presenting with hemodynamic instability for whom regular intravenous thrombolytic therapy might lead to excessively risk of intracranial bleeding, and trans-catheter low-dose thrombolysis in the pulmonary artery may be required. |

STEMI, ST-segment elevation myocardial infarction; NSTEMI, Non-ST segment elevation myocardial infarction.

**Figure Legends**

**Figure 1.** Algorithm for management of critical cardiovascular diseases in regions with a high incidence of COVID-19.

**Figure 2.** Algorithm for management of critical cardiovascular diseases in regions with a low incidence of COVID-19.

* No epidemiological exposure history, with 1-2 clinical manifestations of COVID-19, but not reaching the suspected case diagnosis criteria outside Hubei province