Centers for Disease Control and Prevention

REVIEWED
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Coronavirus Disease 2019 (COVID-19)

Interim Clinical Guidance for Managem Patients with Confirmed Coronavirus D (COVID-19)

Summary of Recent Changes

Revisions were made on April 3, 2020, to reflect the following:

- New information about asymptomatic and pre-symptomatic infections
- Non-steroidal anti-inflammatory drugs, angiotensin-converting enzyme inhibitors, a blockers and risk of infection or infection severity
- Information about COVID-19 and potential for SARS-CoV-2 reinfection
- Possibility of infection with both SARS-CoV-2 and other respiratory viruses
- Additional laboratory and imaging findings in COVID-19
- Updated guidelines from the World Health Organization and the Surviving Sepsis Ca
- Inclusion of new resource: Information for Clinicians on Therapeutic Options for CO
- Inclusion of National Institutes of Health: Coronavirus Disease 2019 (COVID-19) Trea

This interim guidance is for clinicians caring for patients with confirmed infection with sev coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19). CI guidance as more information becomes available.

The National Institutes of Health recently published guidelines on prophylaxis use, testing patients. For more information, please visit: National Institutes of Health: Coronavirus Dis Treatment Guidelines . The recommendations in the guidelines were based on scientifi and will be updated as more data becomes available.

Clinical Presentation

Incubation period

The incubation period for COVID-19 is thought to extend to 14 days, with a median time o symptoms onset.[1-3] One study reported that 97.5% of persons with COVID-19 who develo 11.5 days of SARS-CoV-2 infection.[3]

Presentation

The signs and symptoms of COVID-19 present at illness onset vary, but over the course of COVID-19 will experience the following[1,4-9]:

- Fever (83–99%)
- Cough (59–82%)
- Fatigue (44–70%)
- Anorexia (40–84%)
- Shortness of breath (31–40%)
- Sputum production (28–33%)
- Myalgias (11–35%)

Atypical presentations have been described, and older adults and persons with medical c presentation of fever and respiratory symptoms.[10,11] In one study of 1,099 hospitalized pa 44% at hospital admission but later developed in 89% during hospitalization.[1] Headache, throat, hemoptysis, vomiting, and diarrhea have been reported but are less common (<1(COVID-19 have experienced gastrointestinal symptoms such as diarrhea and nausea prio respiratory tract signs and symptoms.[9] Anosmia or ageusia preceeding the onset of respi anecdotally reported[12], but more information is needed to understand its role in identifyi

Several studies have reported that the signs and symptoms of COVID-19 in children are si milder compared to adults.[13-17] For more information on the clinical presentation and cou Information for Pediatric Healthcare Providers.

Asymptomatic and Pre-Symptomatic Infection

Several studies have documented SARS-CoV-2 infection in patients who never develop syr patients not yet symptomatic (pre-symptomatic).[14,16,18-28] Since asymptomatic persons are prevalence of asymptomatic infection and detection of pre-symptomatic infection is not w found that as many as 13% of RT-PCR-confirmed cases of SARS-CoV-2 infection in childrer study of skilled nursing facility residents infected with SARS-CoV-2 from a healthcare work asymptomatic or pre-symptomatic at the time of contact tracing evaluation and testing.[26] abnormalities on chest imaging before the onset of symptoms.[20,21] Some data suggest tha tended to be detected in younger individuals and was less likely to be associated with vira

Asymptomatic and Pre-Symptomatic Transmission

Epidemiologic studies have documented SARS-CoV-2 transmission during the pre-sympto and asymptomatic transmission has been suggested in other reports.[22,23,32] Virologic stud CoV-2 with RT-PCR low cycle thresholds, indicating larger quantities of viral RNA, and cultu with asymptomatic and pre-symptomatic SARS-CoV-2 infection.[19,24,26,33] The exact degree shedding that confers risk of transmission is not yet clear. Risk of transmission is thought are symptomatic since viral shedding is greatest at the time of symptom onset and declin days to weeks.[33-36] However, the proportion of SARS-CoV-2 transmission in the populatior symptomatic infection compared to symptomatic infection is unclear.[37]

Clinical Course

Illness Severity

The largest cohort of >44,000 persons with COVID-19 from China showed that illness seve critical[38]:

- Mild to moderate (mild symptoms up to mild pneumonia): 81%
- Severe (dyspnea, hypoxia, or >50% lung involvement on imaging): 14%
- Critical (respiratory failure, shock, or multiorgan system dysfunction): 5%

In this study, all deaths occurred among patients with critical illness and the overall case f fatality rate among patients with critical disease was 49%.[38] Among children in China, illne having asymptomatic, mild or moderate disease, 5% having severe disease, and <1% havi COVID-19 cases with known disposition, the proportion of persons who were hospitalized persons with COVID-19 admitted to the intensive care unit (ICU) was 6%.[39]

Clinical Progression

Among patients who developed severe disease, the medium time to dyspnea ranged fron to acute respiratory distress syndrome (ARDS) ranged from 8 to 12 days, and the median from 10 to 12 days.[5,6,10,11] Clinicians should be aware of the potential for some patients to after illness onset. Among all hospitalized patients, a range of 26% to 32% of patients wer Among all patients, a range of 3% to 17% developed ARDS compared to a range of 20% to and 67% to 85% for patients admitted to the ICU.[1,4-6,8,11] Mortality among patients admitte 72% depending on the study.[5,8,10,11] The median length of hospitalization among survivors

Risk Factors for Severe Illness

Age is a strong risk factor for severe illness, complications, and death.[1,6,8,10,11,38-41] Among r cases of COVID-19 in China, the case fatality rate was highest among older persons: ≥80 y 60–69 years: 3.6%, 50–59 years: 1.3%, 40–49 years: 0.4%, <40 years: 0.2%.[38,42] Early U.S. ep the case fatality was highest in persons aged ≥85 years (range 10%–27%), followed by 3%· 1%–3% for ages 55–64 years, and <1% for ages 0–54 years.[39]

Patients in China with no reported underlying medical conditions had an overall case fata higher for patients with comorbidities: 10.5% for those with cardiovascular disease, 7.3% 6% each for chronic respiratory disease, hypertension, and cancer.[42] Heart disease, hyper chronic lung disease, and chronic kidney disease have all been associated with increased outcomes.[1,6,10,11,38,42,43] Accounting for differences in age and prevalence of underlying cor COVID-19 in the United States was similar to China.[39,40,44]

Medications

It has been hypothesized that angiotensin-converting enzyme (ACE) inhibitors or angioter may increase the risk of SARS-CoV-2 infection and COVID-19 severity.[45] ACE inhibitors and of angiotensin-converting enzyme 2 (ACE2). SARS-CoV-2 uses the ACE2 receptor to enter i data to suggest a link between ACE inhibitors or ARBs with worse COVID-19 outcomes. Th (AHA), the Heart Failure Society of America (HFSA), and the American College of Cardiolog recommending continuation of these drugs for patients already receiving them for heart ischemic heart disease.[46]

It has also been hypothesized that non-steroidal anti-inflammatory drugs (NSAIDs) may w there are no data suggesting an association between COVID-19 clinical outcomes and NS

be found at Healthcare Professionals: Frequently Asked Questions and Answers.

Reinfection

There are no data concerning the possibility of re-infection with SARS-CoV-2 after recover shedding declines with resolution of symptoms, and may continue for days to weeks.[11,33,3 RNA during convalescence does not necessarily indicate the presence of viable infectious correlated with the detection of IgM and IgG antibodies which signal the development of i

Viral Testing

Diagnosis of COVID-19 requires detection of SARS-CoV-2 RNA by reverse transcription pol PCR). Detection of SARS-CoV-2 viral RNA is better in nasopharynx samples compared to th respiratory samples may have better yield than upper respiratory samples.[33,50]. SARS-CoV in stool and blood.[13,34,47,51] Detection of SARS-CoV-2 RNA in blood may be a marker of seve may persist over longer periods among older persons and those who had severe illness r (median range of viral shedding among hospitalized patients 12–20 days).[11,33-36]

Infection with both SARS-CoV-2 and with other respiratory viruses has been reported, anc respiratory pathogen does not rule out COVID-19.[53]

For more information about testing and specimen collection, handling and storage, visit E for Coronavirus Disease 2019 (COVID-19) and Frequently Asked Questions on COVID-19 T

Laboratory and Radiographic Findings

Laboratory Findings

Lymphopenia is the most common lab finding in COVID-19 and is found in as many as 83 Lymphopenia, neutrophilia, elevated serum alanine aminotransferase and aspartate amir lactate dehydrogenase, high CRP, and high ferritin levels may be associated with greater D-dimer and lymphopenia have been associated with mortality.[8,11] Procalcitonin is typical may increase among those admitted to the ICU.[4-6] Patients with critical illness had high pl makers, suggesting potential immune dysregulation.[5,55]

Radiographic Findings

Chest radiographs of patients with COVID-19 typically demonstrate bilateral air-space con have unremarkable chest radiographs early in the disease.[1,5,56] Chest CT images from pati demonstrate bilateral, peripheral ground glass opacities.[4,8,38,56-65] Because this chest CT im and overlaps with other infections, the diagnostic value of chest CT imaging for COVID-19 upon interpretations from individual radiologists.[57,66] One study found that 56% of patien of diagnosis had a normal CT[58]. Conversely, other studies have also identified chest CT ab the detection of SARS-CoV-2 RNA.[56,67] Given the variability in chest imaging findings, chest recommended for the diagnosis of COVID-19. The American College of Radiology also doe screening or as a first-line test for diagnosis of COVID-19. (See American College of Radiol

Clinical Management and Treatment

Mild to Moderate Disease

Patients with a mild clinical presentation (absence of viral pneumonia and hypoxia) may n hospitalization, and many patients will be able to manage their illness at home. The decisi inpatient or outpatient setting should be made on a case-by-case basis. This decision will presentation, requirement for supportive care, potential risk factors for severe disease, ar self-isolate at home. Patients with risk factors for severe illness (see People Who Are at Hi should be monitored closely given the possible risk of progression to severe illness in the onset.[5,6,10,11]

For information regarding infection prevention and control recommendations, please see and Control Recommendations for Patients with Confirmed Coronavirus Disease 2019 (C Investigation for COVID-19 in Healthcare Settings.

Severe Disease

Some patients with COVID-19 will have severe disease requiring hospitalization for manag for COVID-19 is currently FDA approved. Corticosteroids have been widely used in hospita illness in China[6,8,10,11]; however, the benefit of corticosteroid use cannot be determined ba observational data. By contrast, patients with MERS-CoV or influenza who were given cort have prolonged viral replication, receive mechanical ventilation, and have higher mortality should be avoided unless indicated for other reasons, such as management of chronic ob exacerbation or septic shock. More information can be found at Healthcare Professionals and Answers.

Inpatient management revolves around the supportive management of the most commo
COVID-19: pneumonia, hypoxemic respiratory failure/ARDS, sepsis and septic shock, card
acute kidney injury, and complications from prolonged hospitalization including secondar
thromboembolism, gastrointestinal bleeding, and critical illness polyneuropathy/myopath

The Infectious Diseases Society of America has released guidelines on the treatment and
COVID-19. For more information, please visit: Infectious Diseases Society of America Guid
Management of Patients with COVID-19 Infection.

The World Health Organization and the Surviving Sepsis Campaign have both released co
inpatient management of patients with COVID-19, including those who are critically ill. For
Guidance on Clinical management of severe acute respiratory infection when novel coron
suspected (WHO) and Surviving Sepsis Campaign: Guidelines on the Management of C
Coronavirus Disease 2019 (COVID-19) .

For more information on the management of children, see Information for Pediatric Healt
Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock a
Dysfunction in Children .

Investigational Therapeutics

No FDA-approved drugs have demonstrated safety and efficacy in randomized controlled
COVID-19. Use of investigational therapies for treatment of COVID-19 should ideally be dc
in randomized controlled trials. Several clinical trials are underway testing multiple drugs
against SARS-CoV-2 and/or immunomodulatory effects that may have clinical benefit. For
Information for Clinicians on Therapeutic Options for COVID-19 Patients. For the informat
U.S., see ClinicalTrials.gov .

Discontinuation of Transmission-Based Precaution
Isolation

Patients who have clinically recovered and are able to discharge from the hospital but wh
their Transmission-Based Precautions may continue isolation at their place of residence u
recommendations on discontinuation of Transmission-Based Precautions or home isolati
recovered from COVID-19 illness, please see: Interim Guidance for Discontinuation of Trai
and Disposition of Hospitalized Patients with COVID-19, Interim Guidance for Discontinua

Patients with COVID-19, and Discontinuation of In-Home Isolation for Immunocompromis

Additional resources:

- Information for Pediatric Healthcare Providers
- Evaluating and Testing Persons for Coronavirus Disease 2019 (COVID-19)
- Frequently Asked Questions on COVID-19 Testing at Laboratories
- Healthcare Professionals: Frequently Asked Questions and Answers
- Interim Infection Prevention and Control Recommendations for Patients with Suspec Disease 2019 (COVID-19) or in Healthcare Settings
- World Health Organization. Interim Guidance on Clinical management of severe acut novel coronavirus (nCoV) infection is suspected
- Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults witl (COVID-19)
- Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and S
- Surviving Sepsis Campaign International Guidelines for the Management of Septic Sh Organ Dysfunction in Children
- Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Officia the American Thoracic Society and Infectious Diseases Society of America
- ACR Recommendations for the use of Chest Radiography and Computed Tomograph Infection
- Infectious Diseases Society of America Guidelines on the Treatment and Managemer Infection
- National Institutes of Health: Coronavirus Disease 2019 (COVID-19) Treatment Guide

References

1. Guan WJ, Ni ZY, Hu Y, et al. Clinical Characteristics of Coronavirus Disease 2019 in Ch *medicine.* 2020.
2. Li Q, Guan X, Wu P, et al. Early Transmission Dynamics in Wuhan, China, of Novel Cor *The New England journal of medicine.* 2020.
3. Lauer SA, Grantz KH, Bi Q, et al. The Incubation Period of Coronavirus Disease 2019 (Reported Confirmed Cases: Estimation and Application. *Annals of internal medicine.*

4. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 case pneumonia in Wuhan, China: a descriptive study. *Lancet (London, England).* 2020;39
5. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel cor *Lancet (London, England).* 2020;395(10223):497-506.
6. Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2 Pneumonia in Wuhan, China. *Jama.* 2020.
7. Xu XW, Wu XX, Jiang XG, et al. Clinical findings in a group of patients infected with the Cov-2) outside of Wuhan, China: retrospective case series. *BMJ (Clinical research ed).*
8. Wu C, Chen X, Cai Y, et al. Risk Factors Associated With Acute Respiratory Distress Sy With Coronavirus Disease 2019 Pneumonia in Wuhan, China. *JAMA Intern Med.* 2020
9. Pan L, Mu M, Ren HG, et al. Clinical characteristics of COVID-19 patients with digestiv descriptive, cross-sectional, multicenter study. *Am J Gastroenterol.* 2020;[Epub ahead
10. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SAR China: a single-centered, retrospective, observational study. *The Lancet Respiratory*
11. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatie China: a retrospective cohort study. *Lancet (London, England).* 2020.
12. Giacomelli A, Pezzati L, Conti F, et al. Self-reported olfactory and taste disorders in SA sectional study. *Clinical Infectious Diseases.* 2020.
13. Cai J, Xu J, Lin D, et al. A Case Series of children with 2019 novel coronavirus infection features. *Clinical infectious diseases : an official publication of the Infectious Disease*
14. Dong Y, Mo X, Hu Y, et al. Epidemiological Characteristics of 2143 Pediatric Patients V in China. *Pediatrics.* 2020.
15. Liu W, Zhang Q, Chen J, et al. Detection of Covid-19 in Children in Early January 2020 *England journal of medicine.* 2020.
16. Lu X, Zhang L, Du H, et al. SARS-CoV-2 Infection in Children. *The New England journa*
17. Wei M, Yuan J, Liu Y, Fu T, Yu X, Zhang ZJ. Novel Coronavirus Infection in Hospitalized China. *Jama.* 2020.
18. Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 20 person-to-person transmission: a study of a family cluster. *Lancet (London, England)*
19. Hoehl S, Berger A, Kortenbusch M, et al. Evidence of SARS-CoV-2 Infection in Returni *The New England journal of medicine.* 2020.
20. Hu Z, Song C, Xu C, et al. Clinical characteristics of 24 asymptomatic infections with C contacts in Nanjing, China. *Science China Life sciences.* 2020.

21. Wang Y, Liu Y, Liu L, Wang X, Luo N, Ling L. Clinical outcome of 55 asymptomatic case admission infected with SARS-Coronavirus-2 in Shenzhen, China. *The Journal of infec*

22. Pan X, Chen D, Xia Y, et al. Asymptomatic cases in a family cluster with SARS-CoV-2 in *diseases.* 2020.

23. Bai Y, Yao L, Wei T, et al. Presumed Asymptomatic Carrier Transmission of COVID-19.

24. Kam KQ, Yung CF, Cui L, et al. A Well Infant with Coronavirus Disease 2019 (COVID-19 *infectious diseases : an official publication of the Infectious Diseases Society of Amer*

25. McMichael TM CS, Pogosjans S, et al. COVID-19 in a Long-Term Care Facility — King C 27–March 9, 2020. *MMWR Morbidity and mortality weekly report.* 2020;69:339-342.

26. Kimball A HK, Arons M, et al. Asymptomatic and Presymptomatic SARS-CoV-2 Infectio Care Skilled Nursing Facility — King County, Washington, March 2020. *MMWR Morbi* 2020;ePub: 27 March 2020.

27. Roxby AC GA, Hatfield KM, et al. Detection of SARS-CoV-2 Among Residents and Staff and Assisted Living Community for Older Adults — Seattle, Washington, 2020. *MMW weekly report.* 2020;ePub: 3 April 2020.

28. Mizumoto K, Kagaya K, Zarebski A, Chowell G. Estimating the asymptomatic proporti (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 202(*Europeen sur les maladies transmissibles = European communicable disease bulleti*

29. Wei WE LZ, Chiew CJ, Yong SE, Toh MP, Lee VJ. Presymptomatic Transmission of SARS 23–March 16, 2020. *MMWR Morbidity and mortality weekly report.* 2020;ePub: 1 Apr

30. Tong ZD, Tang A, Li KF, et al. Potential Presymptomatic Transmission of SARS-CoV-2, *Emerging infectious diseases.* 2020;26(5).

31. Qian G, Yang N, Ma AHY, et al. A COVID-19 Transmission within a family cluster by pr China. *Clinical infectious diseases : an official publication of the Infectious Diseases S*

32. Rothe C, Schunk M, Sothmann P, et al. Transmission of 2019-nCoV Infection from an Germany. *The New England journal of medicine.* 2020;382(10):970-971.

33. Zou L, Ruan F, Huang M, et al. SARS-CoV-2 Viral Load in Upper Respiratory Specimen *England journal of medicine.* 2020;382(12):1177-1179.

34. Young BE, Ong SWX, Kalimuddin S, et al. Epidemiologic Features and Clinical Course CoV-2 in Singapore. *Jama.* 2020.

35. Liu Y, Yan LM, Wan L, et al. Viral dynamics in mild and severe cases of COVID-19. *The* 2020.

36. To KK-W, Tsang OT-Y, Leung W-S, et al. Temporal profiles of viral load in posterior or

serum antibody responses during infection by SARS-CoV-2: an observational cohort s
Diseases. 2020.

37. Li R, Pei S, Chen B, et al. Substantial undocumented infection facilitates the rapid dis
(SARS-CoV2). *Science (New York, NY).* 2020.
38. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus
Outbreak in China: Summary of a Report of 72314 Cases From the Chinese Center fo
Prevention. *Jama.* 2020.
39. CDC COVID-19 Response Team. Severe Outcomes Among Patients with Coronavirus
United States, February 12–March 16, 2020. *MMWR Morbidity and mortality weekly r*
40. Arentz M, Yim E, Klaff L, et al. Characteristics and Outcomes of 21 Critically Ill Patients
State. *Jama.* 2020.
41. Livingston E, Bucher K. Coronavirus Disease 2019 (COVID-19) in Italy. *Jama.* 2020.
42. Novel Coronavirus Pneumonia Emergency Response Epidemiology T. [The epidemiol
outbreak of 2019 novel coronavirus diseases (COVID-19) in China]. *Zhonghua Liu Xin*
2020;41(2):145-151.
43. CDC COVID-19 Response Team. Preliminary Estimates of the Prevalence of Selected
Among Patients with Coronavirus Disease 2019 — United States, February 12–March
mortality weekly report. 2020;ePub: 31 March 2020.
44. McMichael TM CS, Pogosjans S, et al. COVID-19 in a Long-Term Care Facility — King C
27–March 9, 2020. *MMWR Morbidity and mortality weekly report.* 2020.
45. Fang L, Karakiulakis G, Roth M. Are patients with hypertension and diabetes mellitus
infection? *The Lancet Respiratory Medicine.* 2020.
46. HFSA/ACC/AHA. Using RAAS Antagonists in COVID-19. 2020; https://www.acc.org/late
/2020/03/17/08/59/hfsa-acc-aha-statement-addresses-concerns-re-using-raas-antag
March 18, 2020.
47. Zhang W, Du RH, Li B, et al. Molecular and serological investigation of 2019-nCoV infe
multiple shedding routes. *Emerging microbes & infections.* 2020;9(1):386-389.
48. Zhao J, Yuan Q, Wang H, et al. Antibody responses to SARS-CoV-2 in patients of novel
Clinical infectious diseases : an official publication of the Infectious Diseases Society
49. Guo L, Ren L, Yang S, et al. Profiling Early Humoral Response to Diagnose Novel Coro
Clinical infectious diseases : an official publication of the Infectious Diseases Society
50. Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in Different Types of Clinical Spe
51. Wu Y, Guo C, Tang L, et al. Prolonged presence of SARS-CoV-2 viral RNA in faecal sam

Gastroenterology & Hepatology. 2020.

52. Chen W, Lan Y, Yuan X, et al. Detectable 2019-nCoV viral RNA in blood is a strong indi severity. *Emerging microbes & infections.* 2020;9(1):469-473.
53. Ding Q, Lu P, Fan Y, Xia Y, Liu M. The clinical characteristics of pneumonia patients co coronavirus and influenza virus in Wuhan, China. *Journal of medical virology.* 2020.
54. Zhang C, Shi L, Wang FS. Liver injury in COVID-19: management and challenges. *Lanc*
55. Qin C, Zhou L, Hu Z, et al. Dysregulation of immune response in patients with COVID- *infectious diseases : an official publication of the Infectious Diseases Society of Amer*
56. Shi H, Han X, Jiang N, et al. Radiological findings from 81 patients with COVID-19 pne descriptive study. *The Lancet Infectious diseases.* 2020.
57. Ai T, Yang Z, Hou H, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus China: A Report of 1014 Cases. *Radiology.* 2020:200642.
58. Bernheim A, Mei X, Huang M, et al. Chest CT Findings in Coronavirus Disease-19 (CO of Infection. *Radiology.* 2020:200463.
59. Lei J, Li J, Li X, Qi X. CT Imaging of the 2019 Novel Coronavirus (2019-nCoV) Pneumoni
60. Shi H, Han X, Zheng C. Evolution of CT Manifestations in a Patient Recovered from 20 nCoV) Pneumonia in Wuhan, China. *Radiology.* 2020;295(1):20.
61. Wang Y, Dong C, Hu Y, et al. Temporal Changes of CT Findings in 90 Patients with CO Longitudinal Study. *Radiology.* 2020:200843.
62. Xu X, Yu C, Qu J, et al. Imaging and clinical features of patients with 2019 novel coron *journal of nuclear medicine and molecular imaging.* 2020.
63. Yang W, Cao Q, Qin L, et al. Clinical characteristics and imaging manifestations of the (COVID-19):A multi-center study in Wenzhou city, Zhejiang, China. *The Journal of infe*
64. Zhao W, Zhong Z, Xie X, Yu Q, Liu J. Relation Between Chest CT Findings and Clinical C Disease (COVID-19) Pneumonia: A Multicenter Study. *AJR American journal of roentg*
65. Pan F, Ye T, Sun P, et al. Time Course of Lung Changes On Chest CT During Recovery (COVID-19) Pneumonia. *Radiology.* 2020:200370.
66. Bai HX, Hsieh B, Xiong Z, et al. Performance of radiologists in differentiating COVID-1 chest CT. *Radiology.* 2020:200823.
67. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for Typical 2019-nCoV Pneur RT-PCR Testing. *Radiology.* 2020:200343.
68. Zumla A, Hui DS, Perlman S. Middle East respiratory syndrome. *Lancet (London, Engl*

69. Arabi YM, Mandourah Y, Al-Hameed F, et al. Corticosteroid Therapy for Critically Ill Pa Respiratory Syndrome. *American journal of respiratory and critical care medicine.* 20
70. Russell CD, Millar JE, Baillie JK. Clinical evidence does not support corticosteroid treat *Lancet (London, England).* 2020;395(10223):473-475.
71. Corman VM, Albarrak AM, Omrani AS, et al. Viral Shedding and Antibody Response ir Respiratory Syndrome Coronavirus Infection. *Clinical infectious diseases : an official Diseases Society of America.* 2016;62(4):477-483.
72. Rodrigo C, Leonardi-Bee J, Nguyen-Van-Tam JS, Lim WS. Effect of corticosteroid thera mortality: a systematic review and meta-analysis. *The Journal of infectious diseases.*
73. Guo T, Fan Y, Chen M, et al. Cardiovascular Implications of Fatal Outcomes of Patient 2019 (COVID-19). *JAMA Cardiology.* 2020.
74. Inciardi RM, Lupi L, Zaccone G, et al. Cardiac Involvement in a Patient With Coronavir *JAMA Cardiology.* 2020.
75. Shi S, Qin M, Shen B, et al. Association of Cardiac Injury With Mortality in Hospitalized Wuhan, China. *JAMA Cardiology.* 2020.
76. Tang N, Bai H, Chen X, Gong J, Li D, Sun Z. Anticoagulant treatment is associated with coronavirus disease 2019 patients with coagulopathy. *Journal of thrombosis and hae*