IJABR

International Journal of Advanced Biotechnology and Research (IJBR)
ISSN 0976-2612, Online ISSN 2278–599X,
Vol-12, Issue-4, 2021, pp22-31
http://www.bipublication.com

Review Article

A brief review on endemic Corona Virus

Victor Paulinho Da.
Researcher, Working in eFunctionality,
A non-profit research group, Czech Republic.

[Received 11 August-2021, Accepted 30 Sept-2021, Published 15 Oct-2021] 10.5281/zenodo.5599169

ABSTRACT
Corona virus causes respiratory infection including pneumonia, cold, sneezing and coughing while in animal it causes diarrhea and upper respiratory diseases. clinical perspective, adequate therapy should be provided based upon the underlying pathophysiological stage. When viral activity is the principal pathogenic factor, antiviral therapies will be most effective.
As per WHO and ECDC guideline avoid the contact with sick person and also avoid the market or public place as per possible. There are no anti corona virus vaccine to prevent or treatment but some supporting therapy work. Future research needed to fight with corona virus. Till only 'Distance is rescue'.

Keywords: Corona virus, COVID-19, SARS-CoV-2, etiology, Monoclonal antibody therapy

INTRODUCTION:

In December 2019, an outbreak of COVID-19—the disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus—occurred in Wuhan, China, rapidly leading to a global pandemic [1]. As the disease spreads, new information is emerging regarding the clinical course [2]. COVID-19 has three consecutive stages of increasing severity [3]. The early stage is characterized by infection with SARS-CoV-2. In this phase, flu-like symptoms can develop, mainly due to the viral infection itself. Subsequently, patients can develop viral pneumonia, requiring hospitalization, or even mechanical ventilation. The second stage is also characterized by pulmonary inflammation and coagulopathy, which can develop consecutively but often overlap. In addition, increased levels of inflammatory biomarkers such as C-reactive protein (CRP), ferritin, IL-6, IL-1, and D-dimer are associated with the development of acute respiratory distress syndrome (ARDS) and an unfavorable clinical course [3, 4].

The Virus:

Coronaviruses are single-stranded, positive-sense RNA viruses of the Coronaviridae family and Orthocoronavirinae subfamily that in- fect animals and humans. Coronaviruses are classified into four major genera: alphacoronavirus
(α), betacoronavirus (β), gammacoronavirus (γ), and deltacoronavirus (δ)1. Currently, seven kinds of human coronaviruses have been identified, including HCoV 229E and HCoV NL63, which belong to the α genus; and HCoV-OC43, HCo-VHKU1, SARS-CoV, MERS-CoV, and SARSCoV-2, which belong to the β genus.

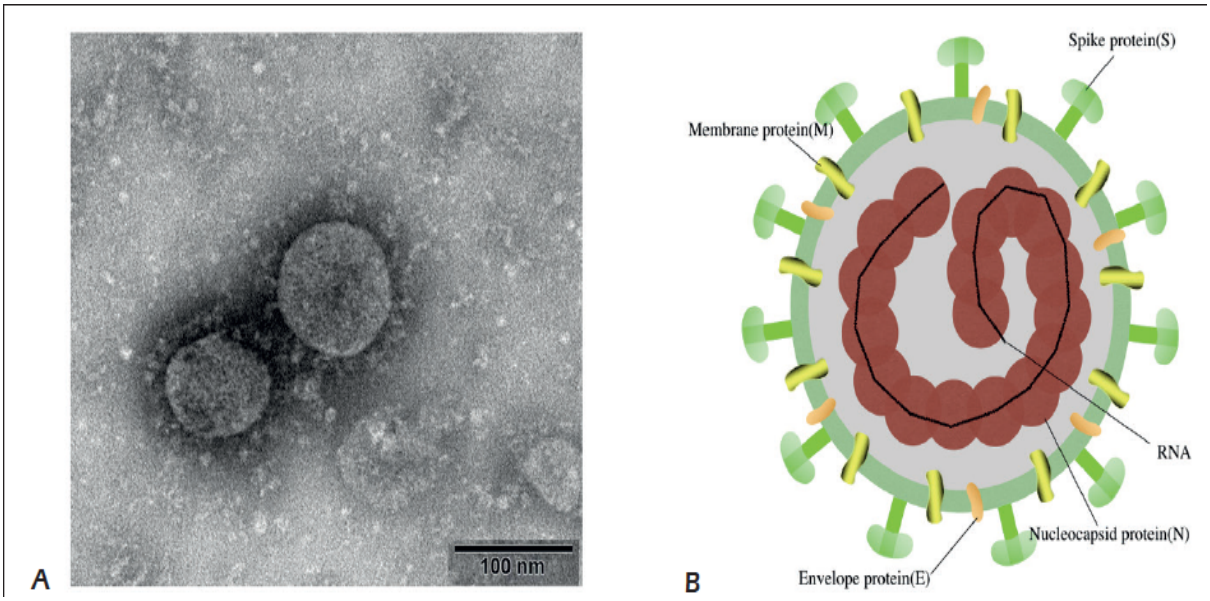

Figure 1. Structure of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). **A,** Viral particles in ultrathin sections under the electron microscope at 200 kV. Chinese name: 2019-nCoV Wuhan strain 02 (English name: C-F13-nCoV Wuhanstrain 02). **B,** SARS-CoV-2 pattern diagram: SARS-CoV-2 includes a single-stranded, positive-sense RNA and four structural proteins: the spike protein (S), envelope protein (E), membrane protein (M), and nucleocapsid protein. Note: the picture in Figure 1A was obtained from the National Pathogen Microbial Resource Bank at the China Center for Disease Control and Prevention (NPRC: 2020.00002).

Transmission — Person-to-person spread is the main mode of SARS-CoV-2 transmission. It is thought to occur mainly through close-range contact (ie, within approximately six feet or two meters) via respiratory particles; virus released in the respiratory secretions when a person with infection coughs, sneezes, or talks can infect another person if it is inhaled or makes direct contact with the mucous membranes. Infection might also occur if a person's hands are contaminated by these secretions or by touching contaminated surfaces and then they touch their eyes, nose, or mouth, although contaminated surfaces are not thought to be a major route of transmission.
Corona virus is spherical or pleomorphic, single stranded, enveloped RNA and covered with club shaped glycoprotein. Corona viruses are four sub types such as alpha, beta,
gamma and delta corona virus. Each of sub type corona viruses has many serotypes. Some of them were affect human of other affected animals such as pigs, birds, cats, mice and dogs.[6–10]

Corona virus was isolated from bronchoalvelor lavage fluid in china in 2020. It is also detected in blood samples. Till now, corona virus was not confirmed in feaces and urine sample of patent.[11–13]
The novelty and high infectivity of COVID-19 requires extra biosafety measures, including appropriate personal and environmental protective equipment.

Histopathology
The predominant pathology in the lungs of deceased patients with COVID-19 is diffuse alveolar damage (DAD).(25-38)
This pattern of acute lung injury is the histologic finding observed in patients with acute respiratory distress syndrome regardless of the etiology. Detection of SARS-CoV-2 RNA in blood has also been reported in some but not all studies that have tested for it [14-18].
The risk of transmission from an individual who is asymptomatic appears less than that from one who is symptomatic [19-24].

RESULTS:

Laboratory tests indicate decreased absolute lymphocyte counts in most patients, suggesting that SARS-CoV-2 may act on lymphocytes in a similar way as SARS. Patients frequently present lymphopenia (70.3%), prolonged coagula- tion (58%), and increased lactate dehydrogenase levels (39.9%)27. White blood cells, hemoglobin, and platelets are lower than the normal range in some patients17, while C-reactive protein and erythrocyte sedimentation rate are elevated(39-40).

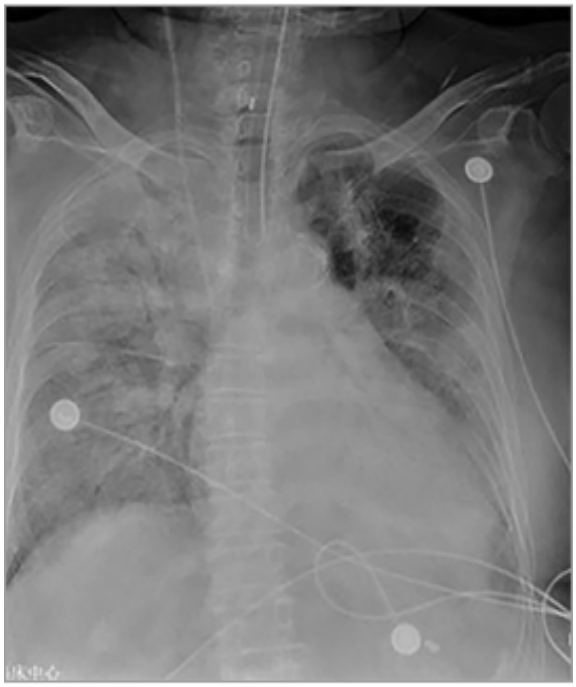

Fig. 2 —79-year-old woman who presented with chest pain, cough, and fever for 3 days. Coronavirus disease (COVID-19) had recently been diagnosed in two of her household members. Patient developed acute respiratory distress syndrome within subsequent few days and died 11 days after admission. (Courtesy of Song F, Shanghai Public Health Clinical Center, Shanghai, China) CT image

After screening the titles and abstracts for eligibility, 116 potentially relevant full-text articles were screened, 74 of which were excluded. No additional articles were retrieved after screening the references in the included articles and excluded reviews. Thus, a total of 42 case reports and case series were included in our systematic review [39-83].

Computed tomography (CT) shows shadows or frosted glass opacity in the lung in most COVID-19 patients(84). Clinically relevant indicators of the disease that significantly deviate from normal values (including oxygen saturation, respiratory rate, white blood cell/lymphocyte count, and chest X-ray/CT findings) predict poor clinical outcomes(85).

Bioinformatic analysis has proposed baricitinib as a potential drug that may inhibit SARS-CoV-2(86).

Monoclonal antibody therapy refers to the extraction of memory B cells from
patients in the recovery stage, which then produce specific antibodies for antiviral therapy given to patients not recovered. Monoclonal antibodies can be obtained by cloning antibody genes from a small number of memory B cells that have neutralizing and specific effects. Studies have shown that monoclonal antibody treatment can significantly reduce the mortality of patients infected with Ebola virus(87). Monoclonal antibody therapy has become a focus of research for COVID-19 treatment.

COCLUSION:

The authors did not find a significant rela-tionship between overall large airway inflammation and intubation, or bacterial or fungal pneumonia.(37)

From a clinical perspective, adequate therapy should be provided based upon the underlying pathophysiological stage. When viral activity is the principal pathogenic factor, antiviral therapies will be most effective. In the vascular stage, directed anti-inflammatory, anticoagulant, and/or anticomplement agents are indicated. Finally, when fibrosis is developing biologicals and/or small-molecule antifibrotic compounds—even those in the experimental stage—should be considered. Currently, in clinical practice a patient's precise pathophysiological state cannot be determined by tissue biopsy, and clinical insight relies upon circumstantial evidence such as RT-PCR to detect viral RNA, laboratory measurements of cytokines and

inflammatory markers, and radiological evaluation.(88)

Organ damages are caused either directly by the virus via the angiotensin converting enzyme 2 receptor or indirectly by the cytokine storm that induces an immune system dysregulation with an activation of the coagulation cascade responsible for disseminated intravascular coagulation and thus multiple organ failure. Further studies are warranted to further understand the pathogenesis of COVID-19.(89)

In other published studies, the most common findings on follow-up CT included increased consolidative opacities and loss of crazy paving pattern. Progression of GGO has been reported as an interval change in the early days after symptomatic presentation. Development of pleural effusions as well as progression to a mixed pattern of GGO and consolidative opacities have been reported in later disease stages [90-92].

Some authors found no significant pathological changes in the heart of patients deceased from COVID-19 infection [20]. Tian. S et al [35]

Lung damages can be caused either directly by the SARS-CoV-2 via the ACE2 receptor or indirectly by cytokine storm which is linked to an excessively exaggerated and uncontrolled immune response (93,94).

revealed no inflammatory cellular infiltration in the endocardium and myocardium of their four patients. However, they found irregularly shaped myocardial cells with darkened cytoplasm. The pathological changes were not sufficient for interpretation as acute myocardial injury. They found, as well, various degrees of focal edema, interstitial fibrosis, and myocardial hypertrophy but they were attributed to the patients' underlying diseases. Xu. Z et al [95] revealed that the only susbtential pathological change in the heart was the presence of few interstitial mononuclear inflammatory infiltrate. On the contrary, all three cases in the study of Yao. XH et al [96] showed hypertrophy, degeneration and necrosis of some myocardial cells, mild interstitial hyperemia, edema, infiltration of a small number of lymphocytes, monocytes and neutrophils. This study performed also Immunohistochemical staining, electron microscopy examination and RTPCR detection of the SARS-CoV-2 in all three heart tissue samples. They showed that the inflammatory cells infiltrating the myocardium were mainly macrophages and a small number were of CD4-positive T lymphocytes. No CD8-positive T lymphocytes or CD20-positive B lymphocyts were seen. Ultrastructural study showed myocardial fibers swelling and dissolution. Immunohistochemical staining and PCR detection did not identify SARS-CoV-2 component in myocardial tissue [96].

Another finding reported is abundant intra-alveolar neutrophilic infiltration consistent with bronchopneumonia of a superimposed bacterial infection [98,99].

Yao. XH et al [96] reported some pathological changes in the gastrointestinal system including partial epithelial degeneration and necrosis, dilatation and congestion of lamina propria and submucosal small blood vessels with infiltration of lymphocytes, monocytes, and plasma cells. Xiao. F et al [97] found no significant damage in the epithelium lining the mucosa of esophagus, stomach, duodenum, and rectum. They observed also an infiltrate of occasional lymphocytes in esophageal squamous epithelium as well as numerous infiltrating plasma cells and lymphocytes with interstitial edema in lamina propria of the stomach, duodenum, and rectum. The viral nucleocapsid protein was visualized.

As per WHO and ECDC guideline avoid the contact with sick person and also avoid the market or public place as per possible. There are no anti corona virus vaccine to prevent or treatment but some supporting therapy work. Future research needed to fight with corona virus. Till only 'Distance
is rescue'.(100)

REFERENCES

1. Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, et al. A new coronavirus

associated with human respiratory disease in China. Nature. 2020;579:265–9.
2. WHO Director-General's remarks at the media briefing on 2019-nCoV on 11 February 2020 2020 [Internet] [cited April 22, 2020]:https://www.who.int/dg/speeches/detail/who-director-general-s-remarks-at-the-media-briefing-on-2019-ncov-on-11-february-2020.
3. WHO-World health organisation
4. Wu C, Chen X, Cai Y, Xia J, Zhou X, Xu S, et al. Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. JAMA Intern Med. 2020;e200994.
5. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395: 1054–62.
6. Mailles A, Blanckaert K, Chaud P, van der Werf S, Lina B, Caro V, et al. First cases of Middle East respiratory syndrome Coronavirus (MERS-CoV) infections in France, investigations and implications for the prevention of human-to-human transmission, Euro Surveill. 2013;18:20502.
7. Buchholz U, Muller MA, Nitsche A, Sanewski A, Wevering N, Bauer-Balci T, et al. Contact investigation of a case of human novel coronavirus infection treated in a German hospital, October-November 2012. Euro Surveill. 2013;18:20406.
8. Saif LJ. Animal coronaviruses: what can they teach us about the severe acute respiratory syndrome? Rev Sci Tech. 2004;23:643–60.
9. Gwaltney JM Jr. Virology and immunology of the common cold. Rhinology. 1985;23:265.
10. Tyrrell DAJ, Myint SH. Chapter 60: Coronaviruses. In Barson 1 S, editor. Medical microbiology. 4th edition. Galveston: University of Texas Medical Branch at Galveston; 1996.
11. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. 24 January 2020. New England Journal of Medicine.
12. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet. 24 January 2020. [CrossRef]
13. Chan JF-W, Yuan S, Kok K-H, To KK-W, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novelcoronavirus indicating person-to-person transmission: a study of a family cluster. The Lancet. 24 January 2020.
14. Chen W, Lan Y, Yuan X, et al. Detectable 2019-nCoV viral RNA in blood is a strong indicator for the further clinical severity. Emerg Microbes Infect 2020; 9:469.
15. Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in Different Types of Clinical Specimens. JAMA 2020; 323:1843.
16. Zheng S, Fan J, Yu F, et al. Viral load dynamics and disease severity in patients infected with SARS-CoV-2 in Zhejiang province, China, January-March 2020: retrospective cohort study. BMJ 2020; 369:m1443.
17. Yu F, Yan L, Wang N, et al. Quantitative Detection and Viral Load Analysis of SARS-CoV-2 in Infected Patients. Clin Infect Dis 2020; 71:793.
18. Xu D, Zhou F, Sun W, et al. Relationship Between Serum Severe Acute Respiratory Syndrome Coronavirus 2 Nucleic Acid and Organ Damage in Coronavirus 2019 Patients: A Cohort Study. Clin Infect Dis 2021; 73:68.
19. Madewell ZJ, Yang Y, Longini IM Jr, et al. Household Transmission of SARS-CoV-2: A Systematic Review and Meta-analysis. JAMA Netw Open 2020; 3:e2031756.
20. Li F, Li YY, Liu MJ, et al. Household transmission of SARS-CoV-2 and risk factors for susceptibility and infectivity in

Wuhan: a retrospective observational study. Lancet Infect Dis 2021; 21:617.
21. Wei WE, Li Z, Chiew CJ, et al. Presymptomatic Transmission of SARS-CoV-2 - Singapore, January 23-March 16, 2020. MMWR Morb Mortal Wkly Rep 2020; 69:411.
22. Buitrago-Garcia D, Egli-Gany D, Counotte MJ, et al. Occurrence and transmission potential of asymptomatic and presymptomatic SARS-CoV-2 infections: A living systematic review and meta-analysis. PLoS Med 2020; 17:e1003346.
23. Plucinski MM, Wallace M, Uehara A, et al. Coronavirus Disease 2019 (COVID-19) in Americans Aboard the Diamond Princess Cruise Ship. Clin Infect Dis 2021; 72:e448.
24. Luo L, Liu D, Liao X, et al. Contact Settings and Risk for Transmission in 3410 Close Contacts of Patients With COVID-19 in Guangzhou, China : A Prospective Cohort Study. Ann Intern Med 2020; 173:879.
25. Bradley BT, Maioli H, Johnston R, et al. Histopathology and ultrastructural findings of fatal COVID-19 infections in Washington State: a case series [published correction appears in Lancet. 2020 Aug 1;396(10247):312]. Lancet. 2020;396(10247):320-332. doi:10.1016/ S0140-6736(20)31305-2
26. Carsana L, Sonzogni A, Nasr A, et al. Pulmonary post-mortem findings in a series of COVID-19 cases from northern Italy: a two-centre descriptive study [published online ahead of print, 2020 Jun 8]. Lancet Infect Dis. 2020;S1473-3099(20)30434-5. doi:10.1016/ S1473-3099(20)30434-5
27. Fox SE, Akmatbekov A, Harbert JL, Li G, Quincy Brown J, Vander Heide RS. Pulmonary and cardiac pathology in African American patients with COVID-19: an autopsy series from New Orleans. Lancet Respir Med. 2020;8(7):681-686. doi:10.1016/S2213-2600(20)30243-5
28. Konopka KE, Nguyen T, Jentzen JM, et al. Diffuse alveolar damage (DAD) resulting from coronavirus disease 2019 Infection is Morphologically Indistinguishable from Other Causes of DAD [published online ahead of print, 2020 Jun 15]. Histopathology. 2020;10.1111/ his.14180. doi:10.1111/his.14180
29. Menter T, Haslbauer JD, Nienhold R, et al. Postmortem examination of COVID-19 patients reveals diffuse alveolar damage with severe capillary congestion and variegated findings in lungs and other organs suggesting vascular dysfunction [published online ahead of print, 2020 May 4]. Histopathology. 2020;10.1111/his.14134. doi:10.1111/his.14134
30. Polak SB, Van Gool IC, Cohen D, von der Thüsen JH, van Paassen J. A systematic review of pathological findings in COVID-19: a pathophysiological timeline and possible mechanisms of disease progression [published online ahead of print, 2020 Jun 22]. Mod Pathol. 2020;1-11. doi:10.1038/s41379-020-0603-3
31. Schaller T, Hirschbühl K, Burkhardt K, et al. Postmortem Examination of Patients With COVID-19. JAMA. 2020;323(24):2518-2520. doi:10.1001/jama.2020.8907
32. Xu Z, Shi L, Wang Y, et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome [published correction appears in Lancet Respir Med. 2020 Feb 25;:]. Lancet Respir Med. 2020;8(4):420-422. doi:10.1016/S2213-2600(20)30076-X
33. Sauter JL, Baine MK, Butnor KJ, et al. Insights into pathogenesis of fatal COVID-19 pneumonia from histopathology with immunohistochemical and viral RNA studies [published online ahead of print, 2020 Jul 2]. Histopathology. 2020;10.1111/his.14201. doi:10.1111/ his.14201
34. von der Thüsen J, van der Eerden M. Histopathology and genetic susceptibility in COVID-19 pneumonia [published online ahead of print, 2020 Apr 30]. Eur J

Clin Invest. 2020;e13259. doi:10.1111/ eci.13259

35. Tian S, Xiong Y, Liu H, et al. Pathological study of the 2019 novel coronavirus disease (COVID-19) through postmortem core biopsies. Mod Pathol. 2020;33(6):1007-1014. doi:10.1038/s41379-020-0536-x
36. Martines RB, Ritter JM, Matkovic E, et al. Pathology and Pathogenesis of SARS-CoV-2 Associated with Fatal Coronavirus Disease, United States. Emerg Infect Dis. 2020;26(9):2005-2015. doi:10.3201/ eid2609.202095
37. Borczuk AC, Salvatore SP, Seshan SV, et al. COVID-19 pulmonary pathology: a multi-institutional autopsy cohort from Italy and New York City [published online ahead of print, 2020 Sep 2]. Mod Pathol. 2020;10.1038/s41379-020-00661-1. doi:10.1038/s41379-020-00661-1
38. Hanley B, Naresh KN, Roufosse C, et al. Histopathological findings and viral tropism in UK patients with severe fatal COVID-19: a post-mortem study [published online ahead of print, 2020 Aug 20]. Lancet Microbe. 2020;10.1016/S2666-5247(20)30115-4. doi:10.1016/ S2666-5247(20)30115-4
39. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, Xia Ja, Yu T, Zhang X, Zhang L. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 2020; 395: 507-513.
40. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, Liu L, Shan H, Lei CL, Hui DSC, Du B, Li LJ, Zeng G, Yuen KY, Chen RC, Tang CL, Wang T, Chen PY, Xiang J, Li SY, Wang JL, Liang ZJ, Peng YX, Wei L, Liu Y, Hu YH, Peng P, Wang JM, Liu JY, Chen Z, Li G, Zheng ZJ, Qiu SQ, Luo J, Ye CJ, Zhu SY, Zhong NS. Clinical characteristics of 2019 novel coronavirus infection in China. medRxiv 2020; 2020.2002.2006.20020974. doi: 10.1101/2020.02.06.20020974.
41. Copin MC, Parmentier E, Duburcq T, Poissy J, Mathieu D Time to consider histologic pattern of lung injury to treat critically ill patients with COVID-19 infection. Intensive Care Med. 2020; 10.1007/s00134-020-06057-8.
42. Magro C, Mulvey JJ, Berlin D, Nuovo G, Salvatore S, Harp J, et al. Complement associated microvascular injury and thrombosis in the pathogenesis of severe COVID-19 infection: a report of five cases. Transl Res. 2020;S1931-5244:30070–0.
43. Barton LM, Duval EJ, Stroberg E, Ghosh S, Mukhopadhyay S. COVID-19 autopsies, Oklahoma, USA. Am J Clin Pathol. 2020;153:725–33.
44. Baud D, Greub G, Favre G, Gengler C, Jaton K, Dubruc E, et al. Second-trimester miscarriage in a pregnant woman with SARSCoV-2 infection. JAMA. 2020;323:2198–2200.
45. Bradley BT, Maioli H, Johnston R, Chaudhry I, Fink SL, Xu H, et al. Histopathology and Ultrastructural Findings of Fatal COVID-19 Infections. medRxiv. 2020;2020.04.17.20058545.
46. Cai Y, Hao Z, Gao Y, Ping W, Wang Q, Peng S, et al. COVID-19 in the perioperative period of lung resection: a brief report from a single thoracic surgery department in Wuhan, China. J Thorac Oncol. 2020;15:1065–72.
47. Carsana L, Sonzogni A, Nasr A, Rossi R, Pellegrinelli A, Zerbi P, et al. Pulmonary post-mortem findings in a large series of COVID-19 cases from Northern Italy. medRxiv 2020;2020.04.19.20054262.
48. Chen JY, Qiao K, Liu F, Wu B, Xu X, Jiao GQ, et al. Lung transplantation as therapeutic option in acute respiratory distress syndrome for COVID-19-related pulmonary fibrosis. Chin Med J (Engl). 2020;10.1097/CM9.0000000000000839.
49. Chen S, Huang B, Luo DJ, Li X, Yang F, Zhao Y, et al. [Pregnant women with new

coronavirus infection: a clinical characteristics and placental pathological analysis of three cases]. Zhonghua Bing Li Xue Za Zhi. 2020;49:E005.
50. Chen Y, Feng Z, Diao B, Wang R, Wang G, Wang C, et al. The novel severe acute respiratory syndrome Coronavirus 2 (SARSCoV-2) directly decimates human spleens and lymph nodes. medRxiv 2020;2020.03.27.20045427.
51. Diao B, Wang C, Wang R, Feng Z, Tan Y, Wang H, et al. Human kidney is a target for novel severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) infection. medRxiv 2020;2020.03.04.20031120.
52. Ding M, Zhang Q, Li Q, Wu T, Huang Y. Correlation analysis of the severity and clinical prognosis of 32 cases of patients with COVID-19. Respir Med. 2020;167:105981.
53. Fernandez-Nieto D, Ortega-Quijano D, Segurado-Miravalles G, Pindado-Ortega C, Prieto-Barrios M, Jimenez-Cauhe J Comment on: Cutaneous manifestations in COVID-19: a first perspective. Safety concerns of clinical images and skin biopsies. J Eur Acad Dermatol Venereol. 2020;10.1111/jdv.16470.
54. Fox SE, Akmatbekov A, Harbert JL, Li G, Quincy Brown J, Vander Heide S. Pulmonary and cardiac pathology in Covid-19:the first autopsy series from New Orleans. medRxiv 2020; 2020.04.06.20050575.
55. Gianotti R, Veraldi S, Recalcati S, Cusini M, Ghislanzoni M, Boggio F, et al. Cutaneous clinico-pathological findings in three COVID-19-positive patients observed in the Metropolitan Area of Milan, Italy. Acta Derm Venereol. 2020;100:adv00124.
56. Karami P, Naghavi M, Feyzi A, Aghamohammadi M, Novin MS, Mobaien A, et al. Mortality of a pregnant patient diagnosed with COVID-19: a case report with clinical, radiological, and histopathological findings. Travel Med Infect Dis. 2020;101665.
57. Kissling S, Rotman S, Gerber C, Halfon M, Lamoth F, Comte D, et al. Collapsing glomerulopathy in a COVID-19 patient. KidneyInt. 2020;10.1016/j.kint.2020.04.006.
58. Kolivras A, Dehavay F, Delplace D, Feoli F, Meiers I, Milone L, et al. Coronavirus (COVID-19) infection-induced chilblains: a case report with histopathological findings. JAAD Case Rep.2020;6:489–92.
59. Konopka KE, Wilson A, Myers JL. Postmortem lung findings in an asthmatic with Coronavirus disease 2019 (COVID-19). Chest. 2020;10.1016/j.chest.2020.04.032.
60. Kuang D, Xu SP, Hu Y, Liu C, Duan YQ, Wang GP. [The pathological changes and related studies of novel coronavirus infected surgical specimen]. Zhonghua Bing Li Xue Za Zhi.2020;49:E008.
61. Lagana SM, De Michele S, Lee MJ, Emond JC, Griesemer AD, Tuin-Silver SA, et al. COVID-19 associated hepatitis complicatingrecent living donor liver transplantation. Arch Pathol Lab Med. 2020;10.5858/arpa.2020-0186-SA.
62. Larsen CP, Bourne TD, Wilson JD, Saqqa O, Sharshir MA. Collapsing glomerulopathy in a patient with Coronavirus disease 2019 (COVID-19). Kidney Int Rep. 2020;5:935–9.
63. Liu Q, Wang RS, Qu GQ, Wang YY, Liu P, Zhu YZ. Gross examination report of a COVID-19 death autopsy. Fa Yi Xue Za Zhi. 2020;36:21–3.
64. Luo W, Yu H, Gou J, Li X, Sun Y, Li J, et al. Clinical pathology of critical patient with novel coronavirus pneumonia (COVID-19). Preprints 2020;2020020407.
65. Schweitzer W, Ruder T, Baumeister R, Bolliger S, Thali M, Meixner E, et al. Implications for forensic death investigations from first Swiss case of non-hospital treatment with COVID-19. Forensic Imaging. 2020;21:200378.

66. Su H, Yang M, Wan C, Yi LX, Tang F, Zhu HY, et al. Renal histopathological analysis of 26 postmortem findings of patients with COVID-19 in China. Kidney Int. 2020;S0085-2538:30369–0.
67. Tavazzi G, Pellegrini C, Maurelli M, Belliato M, Sciutti F, Bottazzi A, et al. Myocardial localization of coronavirus in COVID-19 cardiogenic shock. Eur J Heart Fail. 2020;22:911–5.
68. Tian S, Hu W, Niu L, Liu H, Xu H, Xiao SY. Pulmonary pathology of early-phase 2019 novel Coronavirus (COVID-19) pneumonia in two patients with lung cancer. J Thorac Oncol. 2020;15:700–4.
69. Tian S, Xiong Y, Liu H, Niu L, Guo J, Liao M, et al. Pathological study of the 2019 novel coronavirus disease (COVID-19) through postmortem core biopsies. Mod Pathol. 2020;10.1038/s41379- 020-0536-x.
70. Varga Z, Flammer AJ, Steiger P, Haberecker M, Andermatt R, Zinkernagel AS, et al. Endothelial cell infection and endotheliitis in COVID-19. Lancet. 2020;395:1417–8.
71. Xiao F, Tang M, Zheng X, Liu Y, Li X, Shan H. Evidence for gastrointestinal infection of SARS-CoV-2. Gastroenterology. 2020;158:1831–.e3.
72. Xu SP, Kuang D, Hu Y, Liu C, Duan YQ, Wang GP. [Detection of 2019-nCoV in the pathological paraffin embedded tissue]. Zhonghua Bing Li Xue Za Zhi. 2020;49:E004.
73. Xu Z, Shi L, Wang Y, Zhang J, Huang L, Zhang C, et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. Lancet Respir Med. 2020;8:420–2.
74. Yao XH, Li TY, He ZC, Ping YF, Liu HW, Yu SC. et al. [A pathological report of three COVID-19 cases by minimally invasive autopsies]. Zhonghua Bing Li Xue Za Zhi. 2020;49:E009
75. Zhang H, Zhou P, Wei Y, Yue H, Wang Y, Hu M, et al. Histopathologic Changes and SARS-CoV-2 Immunostaining in the Lung of a Patient With COVID-19. Ann Intern Med. 2020; 172:629–32.
76. Ahouach B, Harant S, Ullmer A, Martres P, Bégon E, Blum L, et al. Cutaneous lesions in a patient with COVID-19: are they related? Br J Dermatol. 2020;10.1111/bjd.19168.
77. Menter T, Haslbauer JD, Nienhold R, Savic S, Hopfer H, Deigendesch N, et al. Post-mortem examination of COVID19 patients reveals diffuse alveolar damage with severe capillary congestion and variegated findings of lungs and other organs suggesting vascular dysfunction. Histopathology. 2020;10.1111/his.14134.
78. 48. Pernazza A, Mancini M, Rullo E, Bassi M, De Giacomo T, Della Rocca C, et al. Early histologic findings of pulmonary SARSCoV-2 infection detected in a surgical specimen. Virchows Arch. 2020;1-6.
79. Wichmann D, Sperhake J-P, Lütgehetmann M, Steurer S, Edler C, Heinemann A, et al. Autopsy findings and venous thromboembolism in patients With COVID-19: a prospective cohort study. Ann Internal Med. 2020;M20-2003.
80. Xu X, Chang XN, Pan HX, Su H, Huang B, Yang M, et al. [Pathological changes of the spleen in ten patients with new coronavirus infection by minimally invasive autopsies]. Zhonghua bing li xue za zhi. 2020;49:E014.
81. WHO 52. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200216-sitrep-27-covid-19.pdf?sfvrsn=78c0eb78_2 accessed at 18/02/2020
82. Yao XH, He ZC, Li TY, Zhang HR, Wang Y, Mou H, et al. Pathological evidence for residual SARS-CoV-2 in pulmonary tissues of a ready-for-discharge patient. Cell Res. 2020;30:541–3.
83. 52. Zeng Z, Xu L, Xie XY, Yan HL, Xie BJ, Xu WZ, et al. Pulmonary pathology of early phase COVID-19 pneumonia in a patient with a benign lung lesion. Histopathology. 2020;10.1111/his.14138.

84. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, Wang B, Xiang H, Cheng Z, Xiong Y, Zhao Y, Li Y, Wang X, Peng Z. Clinical characteristics of 138 hospitalized patients with 2019 Novel Coronavirus-infected pneumonia in Wuhan, China. JAMA 2020;323: 1061-1069.
85. Chang D, Lin M, Wei L, Xie L, Zhu G, Dela Cruz CS, Sharm a L. Epidemiologic and clinical characteristics of novel coronavirus infections involving 13 patients outside Wuhan, China. JAMA 2020; 323:1092-1093.
86. Segler MHS, Preuss M, Wall er MP. Planning chemical syntheses with deep neural networks and symbolic AI. Nature 2018; 555: 604-610.
87. Mulangu S, Dodd LE, Davey RT, Tshiani Mbaya O, Prosc han M, Mukadi D, Lusakibanza Manzo M, Nzolo D, Tshomb a Oloma A, Ibanda A, Ali R, Coulibaly S, Levine AC, Grais R, Diaz J, Lane HC, Muyemb e-Tamfum JJ, the PWG. A randomized, controlled trial of ebola virus disease therapeutics. N Engl J Med 2019; 381: 2293-2303.
88. Samuel B. Polak1, Inge C. Van Gool, Danielle Cohen, Jan H. von der Thüsen, Judith van Paassen, 2020. A systematic review of pathological findings in COVID-19: a pathophysiological timeline and possible mechanisms of disease progression, https://doi.org/10.1038/s41379-020-0603-3 Modern Pathology (2020) 33:2128–2138
89. M. TRIKI1, 2,* ; S. CHARFI1, 2 ; L. BOUZIDI1,2 ; S. MAKNI1,2 ;R. KALLEL1,2 ET T. BOUDAWARA1,2, 2020, PATHOLOGICAL FEATURES OF THE NOVEL HUMAN CORONAVIRUS DISEASE (COVID-19), J.I. M. Sfax, N°35; Juin 20 ; 1 - 7
90. Fang Y, Zhang H, Xu Y, Xie J, Pang P, Ji W. CT manifestations of two cases of 2019 novel corona-virus (2019-nCoV) pneumonia. Radiology 2020 Feb 7
91. Lei J, Li J, Li X, Qi X. CT imaging of the 2019 novel coronavirus (2019-nCoV) pneumonia. Radiology 2020 Jan 31
92. Shi H, Han X, Zheng C. Evolution of CT manifestations in a patient recovered from 2019 novel corona-virus (2019-nCoV) pneumonia in Wuhan, China. Radiology 2020 Feb 7
93. Zhou P, Yang X-L, Wang X-G, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature. 2020; 579: 270‑3.
94. Puellmann K, Beham AW, Kaminski WE. Cytokine storm and an anti-CD28 monoclonal antibody. N Engl J Med. 2006; 355: 2592‑2593.
95. Xu Z, Shi L, Wang Y, Zhang J, Huang L, Zhang C, et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. Lancet Respir Med. 2020; 8:420‑422.
96. Yao X, Li T, He Z, Ping Y, Liu H, Yu S, et al. A pathological report of three COVID-19 cases by minimally invasive autopsies. Zhonghua Bing Li Xue Za Zhi. 2020; 49: 411-417.
97. Xiao F, Tang M, Zheng X, Liu Y, Li X, Shan H. Evidence for gastrointestinal infection of SARS-CoV-2. Gastroenterology. 2020; 158: 1831-1833.
98. Tian S, Xiong Y, Liu H, Niu L, Guo J, Liao M, et al. Pathological study of the 2019 novel coronavirus disease (COVID-19) through postmortem core biopsies. Mod Pathol. 2020; In press.
99. [Barton LM, Duval EJ, Stroberg E, Ghosh S, Mukhopadhyay S. Covid-19 autopsies, oklahoma, USA. Am J Clin Pathol. 2020; 153: 725‑733.
100. Dharmendra Kumar, MD. Department of Pharmacy, Faculty of Medicine and Allied Sciences, Galgotias University, Plot No. 2, Sector 17-A, Yamuna Expressway, Greater Noida, Gautam Buddha Nagar, Uttar Pradesh, India