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Clinical characteristics of 161 cases of corona virus disease 2019 (COVID-19) in Changsha

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Abstract. – OBJECTIVE: In December 2019, a new type of coronavirus-infected pneumonia broke out in Wuhan and spread rapidly to other parts of the country. The purpose of this study was to investigate the clinical features of coronavirus disease 2019 (COVID-19).

MATERIALS AND METHODS: A retrospective analysis was performed on the confirmed cases of COVID-19, who were admitted to the North Hospital of Changsha first Hospital (Changsha Public Health treatment Center) from January 17 to February 7, 2020.

RESULTS: The median age of COVID-19 patients was 45 years (range 33.5-57). The male patients accounted for 49.7%, 64.6% of the patients had a history of exposure in Wuhan, and 31.7% had family aggregation. The median days of onset were six, and the incidence of severe illness was 18.6%. Compared with the non-severe group, the severe group showed statistical significance in older age, hypertension, bilateral lung plaque shadow, decrease in lymphocyte count, increase in C-reactive protein (CRP), aspartate aminotransferase (AST), lactate dehydrogenase, and creatine kinase.

CONCLUSIONS: Age, combined hypertension, oxygenation index, double lung patch, decreased lymphocyte count, and elevated levels of C-reactive protein, aspartate aminotransferase, lactate dehydrogenase, and creatine kinase can be used as predictors of the disease severity.

Key Words:
COVID-19, Pneumonia, Clinical features, Disease severity.

Introduction

Since December 2019, numerous cases of coronavirus disease 2019 (COVID-19) have been reported in Wuhan, Hubei Province[1]. With the outbreak of the epidemic, such cases have been reported in many regions of the country and abroad[2,3]. The novel coronavirus (COVID-19) belongs to β genus of coronavirus, which also includes Atypical Pneumonia Virus (SARS-CoV) and Middle East Respiratory Syndrome Virus (MERS-CoV). The clinical manifestation and severity of COVID-19 are similar to that of SARS-CoV[4]. As of February 11, 2020, a total of 72,314 cases have been reported nationwide, with 44,672 confirmed cases (61.8%), 8255 cases of severe and critical illness, and a case fatality rate of 2.3%[5]. In this study, the epidemiological and clinical characteristics of COVID-19 patients diagnosed by Changsha Public Health Center have been reported. The study aimed to understand these clinical characteristics and compare the differences between severe and non-severe groups. Besides, the risk factors of severe cases have been discussed, which can be helpful for clinicians to predict the severity of the novel coronavirus's pneumonia in the early stage.

Materials and Methods

A retrospective analysis was conducted on the confirmed cases of COVID-19 admitted to the North Hospital of Changsha First Hospital (Changsha Public Health Center) from January 17 to February 7, 2020. This study was approved by the First Hospital of Changsha Ethics Committee. Before the survey,participants were asked to sign an informed consent to identify their willingness to take part in this study,and to ensure their rights of voluntary participation and privacy. The demography, epidemiology (including Wuhan exposure history and family aggregation) and clinical data on admission, including clinical symptoms, chest computerized tomography (CT) and laboratory results were collected. According to the COVID-19 diagnosis and treatment plan issued by the National Health Commission (trial version 5), all cases were divided into severe and non-se-

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Table I. Demographic and epidemiological characteristics of COVID-19 patients.

	All patients (N=161)	Non-severe (N=131)	Severe (N=30)		*p*-value
Age	45 (33.5, 57)	40 (31, 51)	57 (46.5, 66)	-4.22	<0.05
Gender				0.135	0.714
Male	80 (49.7%)	66 (50.4%)	14 (46.7%)		
Female	81 (50.3%)	65 (49.6%)	16 (53.3%)		
Wuhan exposure history	104 (64.6%)	84 (64.1%)	20 (66.7%)	0.069	0.793
Family gathering	51 (31.7%)	43 (32.8%)	8 (26.7%)	0.428	0.513
Days of onset	6 (3, 8)	6 (3, 8)	6 (3.75, 8)	-0.116	0.909
Underlying diseases	33 (20.5%)				
High blood pressure	22 (13.7%)	10 (7.6%)	12 (40%)	21.676	<0.05
Diabetes mellitus	7 (4.3%)	5 (3.8%)	2 (6.7%)	0.477	0.490
Chronic obstructive pulmonary disease	6 (3.7%)	4 (3.1%)	2 (6.7%)	0.888	0.346
Coronary heart disease	4 (2.5%)	2 (1.5%)	2 (6.7%)	2.662	0.103
Cerebrovascular disease	4 (2.5%)	3 (2.3%)	1 (3.3%)	0.110	0.741
Chronic liver disease	4 (2.5%)	4 (3.1%)	0	0.939	0.332

vere groups for comparison. Continuous variables were represented by interquartile range (IQR), and the rank-sum test was used. The classification variables were represented by the count and percentage in the category, and chi-square test was used to determine the statistical significance. The Statistical Product and Service Solution (SPSS) 24 software (IBM Corp., Armonk, NY, USA) was used for statistical analysis, and a *p-value* <0.05 was considered to be statistically significant.

Result

As of February 7, 2020, the North Hospital of Changsha first Hospital (Changsha Public Health Center) has treated 171 cases of COVID-19, of which 161 cases were diagnosed as COVID19, and the other 10 cases who did not meet COVID-19 diagnostic criteria were excluded from the study. The demography and epidemiology of all diagnosed COVID-19 patients are shown in Table I. This includes 30 severe cases and 131 non-severe cases, with a 18.6% prevalence of severe cases. The median age of all patients was 45 years old (IQR 33.5, 57). There was a statistically significant difference in age between the severe and non-severe groups (p<0.05), with males accounting for 49.7% cases. A total of 64.6% cases had a recent history of exposure in Wuhan, with family clustering cases reaching 31.7% and a median onset of six days. At least 20.5% cases had one underlying disease including hypertension, diabetes mellitus, coronary heart disease, chronic obstructive pulmonary disease, cerebrovascular disease, and chronic liver disease. The prevalence of severe disease in patients with hypertension was significantly higher than that in the non-severe group (p<0.05).

Table II. Clinical symptoms of patients with COVID-19.

	All patients (N=161)	Non-severe (N=131)	Severe (N=30)		*p*-value
Fever	122 (75.8%)	93 (71%)	29 (96.7%)	8.766	<0.05
Cough	101 (62.7%)	80 (61.1%)	21 (70%)	0.833	0.361
Dyspnea	23 (14.3%)	14 (10.7%)	9 (30%)	7.435	<0.05
Muscle ache	18 (11.2%)	14 (10.7%)	4 (13.3%)	0.172	0.678
Headache	12 (7.5%)	8 (6.1%)	4 (13.3%)	1.848	0.174
Diarrhea	17 (10.6%)	16 (12.2%)	1 (3.3%)	2.038	0.153
Fatigue	64 (39.8%)	49 (37.4%)	15 (30%)	1.617	0.204
Nausea	6 (3.7%)	6 (4.6%)	0	1.427	0.232

Figure 1. Ground-glass opacity.

Figure 4. Focal lesions (patch shadow).

Fever (71%) and cough (61.1%) were the most common clinical manifestations. Fatigue (39.8%) was frequently reported. Muscle soreness, diarrhea, nausea, and headache were rare. There were significant differences in fever and dyspnea between the severe group and the non-severe group at admission (p<0.05) (Table II).

Chest CT examination served as an important basis for the diagnosis of COVID-19 (Figures 1-6). The common manifestations were ground glass shadow (50.9%), focal lesions (patch or nodule shadow) (70.2%) and bilateral lung patch shadow (55.3%), while interstitial fibrosis was rare (1.2%). There was a significant difference in the patchy shadow of both

Figure 2. Ground-glass opacity.

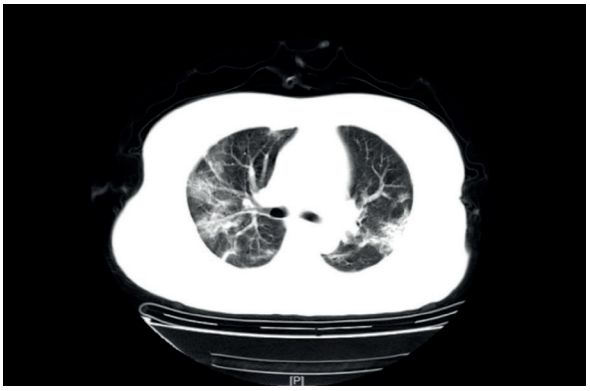

Figure 5. Bilateral lung patch shadow.

Figure 3. Focal lesions (nodule shadow).

Figure 6. Interstitial fibrosis.

Table III. CT characteristics of COVID-19 patients' chest.

	All patients (N=161)	Non-severe (N=131)	Severe (N=30)		*p*-value
Ground-glass opacity	82 (50.9%)	62 (47.3%)	20 (66.7%)	3.653	0.056
Focal lesion	113 (70.2%)	94 (71.8%)	19 (63.3%)	0.828	0.363
Bilateral patch shadow	89 (55.3%)	63 (48.1%)	26 (86.7%)	14.693	<0.05
Interstitial fibrosis	2 (1.2%)	1 (0.8%)	1 (3.3%)	1.314	0.252

lungs between the severe group and the non-severe group at admission (p<0.05) (Table III).

The results of laboratory tests are shown in Table IV. Common indicator abnormalities include decreased white blood cell count (41.0%), increased C reactive protein (75.2%) and lactate dehydrogenase (LDH) levels (23.6%), and decreased lymphocyte count (26.1%). Compared with the non-severe group, the oxygenation index (Median PaO_2:FiO_2) and the lymphocyte count were decreased, C-reactive protein increased, aspartate aminotransferase (AST), lactate dehydrogenase, and creatine kinase were increased, with significant differences (p<0.05).

Discussion

As of February 7, 2020, median age of the COVID-19 patients admitted to Changsha Public Health Center was 45 years, and the prevalence of severe illness was 18.6%. The median age of the severe group was 57 years, and there was a statistical difference in age between the severe group, and the non-severe group. It is suggested that older age is a risk factor. Earlier, clinical studies[6] on influenza virus pneumonia have shown that advanced age is a high-risk factor for severe illness. About one-fifth of total patients were associated with at least one underlying disease. Chen et al[1]

Table IV. Laboratory characteristics of patients with COVID-19.

	All patients (N=161)	Non-severe (N=131)	Severe (N=30)		*p*-value
White blood cell count (×10^9/L)	4.36 (3.33, 5.42)	4.17 (3.33, 5.24)	4.76 (3.18, 5.74)	-0.768	0.442
<4.0	66 (41.0%)	57 (43.5%)	9 (30%)	2.841	0.242
4.0-10.0	92 (57.1%)	71 (54.2%)	21 (70%)		
>10.0	3 (1.9%)	3 (2.3%)	0		
Hemoglobin (g/L)	130 (120,141)	131 (121,141)	126 (118,141)	-0.912	0.362
<110	13 (8.1%)	11 (8.4%)	2 (6.7%)	0.098	0.754
Platelet count (× 10^9/L)	168 (131,220)	171 (137,221)	160 (133,214)	-0.708	0.479
<100	11 (6.8%)	8 (6.1%)	3 (10%)	0.581	0.446
Lymphocyte count (×10^9/L)	1.07 (0.77, 1.43)	1.12 (0.84, 1.45)	0.85 (0.69, 1.06)	-3.304	<0.05
<0.8	42 (26.1%)	29 (22.1%)	13 (43.3%)	5.688	<0.05
Oxygenation index	366 (316,393)	373 (345,400)	259 (247,278)	-8.425	<0.05
Alanine aminotransferase (u/L)	20.3 (15.0, 24.5)	19.3 (14.6, 17.8)	23.9 (17.6, 35.3)	-2.197	0.28
>40	13 (8.1%)	8 (6.1%)	5 (16.7%)	3.667	0.055
Aspartate aminotransferase (u/L)	25.1 (19.9, 32.8)	23.4 (19.0, 28.8)	31.6 (25.9, 49.36)	-4.307	<0.05
>40	22 (13.7%)	10 (7.6%)	12 (40%)	21.676	<0.05
Total bilirubin (umol/L)	10.9 (8.37, 15.43)	10.7 (8.18, 15.3)	12.7 (9.2, 16.9)	-1.257	0.209
>20.5	9 (5.6%)	6 (4.6%)	3 (10%)	1.359	0.244
Serum creatinine (umol/L)	48.2 (38.9, 58.2)	48.3 (38.8, 57.9)	47.5 (39.2, 64.2)	-0.195	0.845
>87	2 (1.2%)	1 (0.8%)	1 (3.3%)	1.314	0.252
Creatine kinase (u/L)	72.9 (45.4, 72.2)	68.7 (43.2, 111.3)	100.3 (61.3, 398.6)	-2.802	<0.05
>190	17 (10.6%)	8 (6.1%)	9 (30%)	14.705	<0.05
Lactate dehydrogenase (u/L)	177.1 (141.0, 221.9)	162.0 (133.7, 208.5)	226.2 (193.5, 315.1)	-5.407	<0.05
>225	38 (23.6%)	23 (17.6%)	15 (50%)	14.248	<0.05
C-reactive protein, mg/L	17.9 (8.1, 36.7)	15.4 (5.8, 24.9)	52.2 (28.8, 75.1)	-6.095	<0.05
>8	121 (75.2%)	91 (69.5%)	30 (100%)	12.189	<0.05

have also reported that nearly 50% of infected patients were having an underlying disease. Our results are relatively close to the national statistics. As of February 11, 2020, the number of severe and critical cases nationwide were 6,168 and 2,087, respectively, with a total prevalence of 18.4%, and most cases occurred in older people with an underlying basic disease[5]. These elderly patients with underlying disease are prone to be affected by the original disease after a viral infection, and most would develop respiratory failure[7]. Our study found that the proportion of severe patients with hypertension was higher than that among the non-severe group. A multi-center retrospective study[8] involving 1,099 patients was consistent with our findings, suggesting that hypertension may be a serious risk factor. It is well known that high levels of renin-angiotensin (RAS) is an important cause of hypertension[9]. New coronaviruses enter cells by binding to angiotensin converting enzyme 2 (ACE 2)[10], and virus replication may also be closely related to ACE2[11]. In a mouse model, the SRAS-CoV infection can downregulate the expression of ACE2 and activate RAS to cause lung injury[12]. Liu et al[13] indicate that a significant increase in angiotensin II levels in patients with COVID-19 is highly correlated with lung injury. Based on this, it is reasonable to suspect that COVID-19 in hypertensive patients aggravates lung injury by further activating RAS; this may be the potential cause of hypertension as a severe high-risk factor, of course, this needs to be verified by further studies. In this study, the proportion of patients with hypertension is as high as 40%, probably because it is a single-center study, and employed a relatively small sample size. Most cases have a history of exposure in Wuhan, which are mainly divided into three categories: residents of Wuhan or other cities in Hubei, local residents who travel to Wuhan, and local residents, which may have contacted the former two. Most of the critically ill patients were imported cases in the early stages of the outbreak, but there was no significant difference in Wuhan exposure history between severe group and the non-severe group. Familial clustering cases have also attracted attention[14]. In this study, more than one-third of the cases showed that the virus is highly contagious between humans. A previous study estimated that the number of primary infections was 2.2[15], which may be an underestimation from the current situation. We have also observed an increasing number of early asymptomatic cases of infection, which may indicate a longer incubation period of the virus or a decrease in virus virulence during intergenerational transmission[16]. The number of cases need to be expanded, and further epidemiological investigations would be required for verification.

The common symptoms of patients are fever and cough, most of which are dry cough without sputum, which is closely related to the virus mainly transmitted through the respiratory tract. Almost all severe cases had a fever, and nearly one-third of them were accompanied by dyspnea, muscle soreness, nausea, and some rare instances of headache. These symptoms were all manifestations of viremia and may be closely related to the distribution of virus receptor ACE2[11,17]. A small number of diarrhea cases may be closely related to the virus found in stool samples[2]. In some mild cases, the above symptoms are simply ignored by the patients themselves.

Chest CT examination is an important basis for screening, confirming, and assessing the severity of the new coronavirus pneumonia and its evolution[18]. The common manifestations of chest CT examination of all COVID-19 patients on admission were ground glass shadow, focal lesions (patches, stripes or nodules), and bilateral patches, which are also common manifestations of most viral pneumonia[19]. We found that most cases had lesions of varying nature and extent, and reports have shown that these lesions may be related to the duration of disease[20]. At the time of admission, the exudation consolidation of bilateral lung patches in the severe group was higher, compared to the non-severe group, which was, in fact, consistent with the severity of the disease itself. A recent retrospective study[21] on viral pneumonia showed a high prevalence of multiple lobar lesions, which can be used as a risk factor for predicting severity.

Laboratory examinations at the time of admission often showed a decrease in white blood cell counts, a decrease in lymphocyte counts, an increase in C-reactive protein and lactate dehydrogenase levels, and an increase in aspartate aminotransferase and creatine kinase, which are basically consistent with the earlier studies[1,22]. Compared with the non-severe group, the lymphocyte count decreased, C-reactive protein increased, aspartate aminotransferase increased, lactate dehydrogenase, and creatine kinase increased significantly in the severe group. These indexes are helpful to predict the condition of critically ill patients, and are highly related to the degree of acute lung injury caused by novel coro-

navirus[13]. In prospective studies, patients with community-acquired virus-infected pneumonia and respiratory failure had higher levels of creatine kinase, and increased lactate dehydrogenase was associated with death[23]. Some scholars have also proposed the use of neutrophil-to-lymphocyte ratios as an independent risk factor for predicting the severity of COVID-19, but the sample size is small, and most of the cases have not yet completed the treatment, resulting in a lack of final survival outcome[24].

This study had some limitations. Firstly, this was a single-center study involving a small number of cases with no multi-factor correction to assess the severity of the disease. Secondly, some clinical and laboratory data were missing and cannot be included. Furthermore, the study data were mainly collected from the baseline assessment of patients at admission.

Conclusions

To summarize, COVID-19 may have a severe tendency in older patients with hypertension. The oxygenation index, bilateral lung plaque shadow and biochemical indexes (decreased lymphocyte count, increased C-reactive protein, increased aspartate aminotransferase, increased lactate dehydrogenase and creatine kinase) can be used as indicators to predict the severity of the disease.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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References

1) Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, Xia J, 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.

2) Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, Spitters C, Ericson K, Wilkerson S, Tural A, Diaz G, Cohn A, Fox L, Patel A, Gerber SI, Kim L, Tong S, Lu X, Lindstrom S, Pallansch MA, Weldon WC, Biggs HM, Uyeki TM, Pillai SK; Washington State 2019-nCoV Case Investigation Team. First case of 2019 novel coronavirus in the United States. N Engl J Med 2020; 382: 929-936.

3) Phan LT, Nguyen TV, Luong QC, Nguyen TV, Nguyen HT, Le HQ, Nguyen TT, Cao TM, Pham QD. Importation and human-to-human transmission of a novel coronavirus in Vietnam. N Engl J Med 2020; 382: 872-874.

4) Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R, Niu P, Zhan F, Ma X, Wang D, Xu W, Wu G, Gao GF, Tan W; China Novel Coronavirus Investigating and Research Team. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020; 382: 727-733.

5) Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China). Zhonghua Liu Xing Bing Xue Za Zhi 2020; 41: 145-151.

6) Ishiguro T, Kagiyama N, Uozumi R, Odashima K, Takaku Y, Kurashima K, Morita S, Takayanagi N. Clinical characteristics of influenza-associated pneumonia of adults: clinical features and factors contributing to severity and mortality. Yale J Biol Med 2017; 90: 165-181.

7) Fica A, Sotomayor V, Fasce R, Dabanch J, Soto A, Charpentier P, Guerrero G, Olivares F, Triantafilo V, Omeiri NE, Gaínza-Lein M. Severe acute respiratory infections (SARI) from influenza in adult patients in Chile: the experience of a sentinel hospital. Rev Panam Salud Publica 2019; 43: e1.

8) Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, Liu L, Shan H, Lei C, Hui S, Du B, Li L, Zeng G, Yuen K, Chen R, Tang C, Wang T, Chen P, Xiang J, Li S, Wang J, Liang Z, Peng Y, Wei L, Liu Y, Hu Y, Peng P, Wang J, Liu J, Chen Z, Li G, Zheng Z, Qiu S, Luo J, Ye C, Zhu S, Zhong N. Clinical characteristics of 2019 novel coronavirus infection in China. medRxiv 2020; doi: 10.1101/2020.02.06.20020974.

9) Saxena T, Ali A O, Saxena M. Pathophysiology of essential hypertension: an update. Expert Rev Cardiovasc Ther 2018; 16: 879-887.

10) Hoffmann M, Kleine-Weber H, Krüger N, Müller M, Drosten C, Pöhlmann S. The novel coronavirus 2019 (2019-nCoV) uses the SARS-coronavirus receptor ACE2 and the cellular protease TMPRSS2 for entry into target cells. bioRxiv 2020; doi: 10.1101/2020.01.31.929042.

11) Zhao Y, Zhao Z, Wang Y, Zhou Y, Ma Y, Zuo W. Single-cell RNA expression profiling of ACE2, the putative receptor of Wuhan 2019-nCov. bioRxiv 2020; doi: 10.1101/2020.01.26.919985.

12) Kuba K, Imai Y, Rao S, Gao H, Guo F, Guan B, Huan Y, Yang P, Zhang Y, Deng W, Bao L, Zhang B, Liu G, Wang Z, Chappell M, Liu Y, Zheng D, Leibbrandt A, Wada T, Slutsky AS, Liu D, Qin C, Jiang C, Penninger JM. A crucial role of angiotensin converting enzyme 2 (ACE2) in SARS coronavirus-induced lung injury. Nat Med 2005; 11: 875-879.

13) Liu Y, Yang Y, Zhang C, Huang F, Wang F, Yuan J, Wang Z, Li JX, Li J, Feng C, Zhang Z, Wang L, Peng L, Chen L, Qin Y, Zhao D, Tan S, Yin L, Xu J, Zhou C, Jiang C, Liu L. Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury. Sci China Life Sci 2020; 63: 364-374.

14) Chan J, Yuan S, Kok K, To K, Chu H, Yang J, Xing F, Liu J, Yip C, Poon R, Tsoi H, Lo S, Chan K, Poon V, Chan W, Ip J, Cai J, Cheng V, Chen H, Hui C, Yuen K. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet 2020; 395: 514-523.

15) Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, Ren R, Leung K, Lau E, Wong J, Xing X, Xiang N. Early transmission dynamics in Wuhan, China, of Novel coronavirus-infected pneumonia. N Engl J Med 2020; doi: 10.1056/NEJMoa2001316.

16) Yu P, Zhu J, Zhang Z, Han Y, Huang L. A familial cluster of infection associated with the 2019 novel coronavirus indicating potential person-to-person transmission during the incubation period. J Infect Dis 2020; pii: jiaa077. doi: 10.1093/infdis/jiaa077.

17) Wang J, Zhao S, Liu M, Zhao Z, Xu Y, Wang P, Lin M, Xu Y, Huang B, Zuo X, Chen Z, Bai F, Cui J, Lew A, Zhao J, Zhang Y, Luo H, Zhang Y. ACE2 expression by colonic epithelial cells is associated with viral infection, immunity and energy metabolism. medRxiv 2020; doi: 10.1101/2020.02.05.20020545.

18) Zu Z, Jiang M, Xu P, Chen W, Ni Q, Lu G, Zhang L. Coronavirus disease 2019 (COVID-19): a perspective from China. Radiology 2020; doi: 10.1148/radiol.2020200490.

19) Koo H, Lim S, Choe J, Choi S, Sung H, Do K. Radiographic and CT features of viral pneumonia. Radiographics 2018; 38: 719-739.

20) Bernheim A, Mei X, Huang M, Yang Y, Fayad Z, Zhang N, Diao K, Lin B, Zhu X, Li K, Li S, Shan H, Jacobi A, Chung M. Chest CT findings in coronavirus disease-19 (COVID-19): relationship to duration of infection. Radiology 2020; 200463. doi: 10.1148/radiol.2020200463.

21) Guo L, Wei D, Zhang X, Wu Y, Li Q, Zhou M, Qu J. Clinical features predicting mortality risk in atients with viral pneumonia: the MuLBSTA score. Front Microbiol 2019; 10: 2752.

22) Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X, Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020; 395: 497-506.

23) Tao R, Luo X, Xu W, Mao B, Dai R, Li C, Yu L, Gu F, Liang S, Lu H, Chen K, Bai J, Ji X, Gu S, Sun X, Dai F, Jiang P, Cao W, Xu J. Viral infection in community acquired pneumonia patients with fever: a prospective observational study. J Thorac Dis 2018; 10: 4387-4395.

24) Liu J, Liu Y, Xiang P, Pu L, Xiong H, Li C, Zhang M, Tan J, Xu Y, Song R, Song M, Wang L, Zhang W, Han B, Yang L, Wang X, Zhou G, Zhang T, Li B, Wang Y, Chen Z, Wang X. Neutrophil-to-lymphocyte ratio predicts severe illness patients with 2019 novel coronavirus in the early stage. medRxiv 2020; doi: 10.1101/2020.02.10.20021584.