

Clinical Characteristics of COVID-19 and the Value of Mulbsta Scoring System in Prognosis Evaluation

Chao Wang

Tongji Medical College Affiliated Wuhan Puai Hospital

Zhixiu Luo

Tongji Medical College Affiliated Wuhan Puai Hospital

Junyi Wu

Tongji Medical College Affiliated Wuhan Puai Hospital

Jie Zhou

Tongji Medical College Affiliated Wuhan Puai Hospital

Yahang Lin

Tongji Medical College Affiliated Wuhan Puai Hospital

Guilin Yan

Tongji Medical College Affiliated Wuhan Puai Hospital

Manman Yan

Tongji Medical College Affiliated Wuhan Puai Hospital

Xi Wang

Tongji Medical College Affiliated Wuhan Puai Hospital

Hanhua Yu

Tongji Medical College Affiliated Wuhan Puai Hospital

Xiaoyun Zeng (✉ yswangchao1991@163.com)

Tongji Medical College Affiliated Wuhan Puai Hospital

Research

Keywords: COVID-19, Clinical characteristics, Laboratory findings, MuLBSTA

Posted Date: June 17th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-35521/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background

COVID-19, a worldwide infectious disease, has killed more than 420,000 people, which is extremely harmful.

Methods

In this single-center retrospective study, we included the novel coronavirus pneumonia confirmed in our hospital. This study collected the basic information and clinical examination features.

Results

The enrolled 704 patients were affirmed infected with 2019-nCoV by the test of throat swabs. There are 334 men and 369 women, and gender, age, combined with basic diseases are distinct in diverse disease classification ($p < 0.05$). From the symptom analysis, the proportion of fever over 38 degrees, dyspnea, fatigue, poor appetite and other symptoms is diverse in different types of diseases ($p < 0.05$). As the severity of the disease increases, the median lymphocyte count decreases, C-reactive protein increase, erythrocyte sedimentation rate increase, albumin decrease, pleural effusion increase, D-Dimer and NT-proBNP increase significantly ($p < 0.05$). As the disease severity increases, the average value of MuLBSTA score obviously ascend ($p < 0.05$), MuLBSTA scoring system predicts novel coronavirus pneumonia patients' prognosis is still insufficient, and may require additional indicators including anorexia, fatigue, C reactive protein, etc ($p < 0.05$).

Conclusion

The MuLBSTA evaluation system has certain value for the evaluation of the disease, but it needs to be improved.

Introduction

The novel coronavirus 2 of severe acute respiratory syndrome (SARS-CoV-2), a novel beta-coronavirus, has caused COVID-19 [1, 2], which has become a worldwide pandemic disease, with a total number of more than 4.5 million people infected. On March 11, WHO officially defined the pneumonia epidemic as "pandemic" in Geneva, and so far, novel coronavirus pneumonia has resulted in over 420 thousand deaths. The most common clinical symptoms at onset are fever, dry cough, chest distress, dyspnea, fatigue, poor appetite, and loss of smell [3]. Clinically, we found that patients with the same clinical manifestations have great differences in disease changes and prognosis. Owing to the complexity of COVID-19, it is significantly important to analyze the clinical characteristics of patients and judge the prognosis of patients in the early stage.

The MuLBSTA score, an early prediction model of mortality in viral pneumonia[4, 5]. *Lingxi Guo* found that the MuLBSTA score, based on 6 parameters (multilobular infiltration, lymphopenia, bacteria co-infection, smoking history, hypertension, and age), has a powerful prediction 90-day mortality[5]. *Nanshan Chen* mentioned that further examination is required to evaluate the usability of MuLBSTA score on mortality of COVID-19[4]. Our study not only examined the predictive value of the MuLBSTA score for the risk of mortality in novel coronavirus pneumonia, but also investigated the relationship between the MuLBSTA score and the disease level of the novel coronavirus pneumonia. What's more, novel coronavirus pneumonia prognosis is evaluated by MuLBSTA score in this article, and we also assessed the value of the MuLBSTA score and the parameters that may be needed to further refine it.

Methods

Research design

For this single-center retrospective study, we included the novel coronavirus pneumonia confirmed in our hospital for the first time (excluding patients hospitalized outside the hospital) from January to March. The concrete inclusion criteria: 1. The patients were first hospitalization and diagnosed as novel coronavirus pneumonia throughout the course of the disease by the practice guidelines. 2. The case data are complete and have laboratory examination results within 24 hours after admission to the hospital, maximum body temperature within 5 days before admission and chest CT results within 3 days after admission. All patient data are from Wuhan Fourth hospital, and the study was approved by Wuhan Fourth Hospital Ethics Committee. Case screening process is as shown in the Fig. 1. As shown in Fig. 1, 68% of the cases finally screened are qualified. More concretely, the number of cases that do not meet condition 1 is about 26%, and the number of cases that do not meet condition 2 is about 6%.

This study collected the age, gender, past medical history, smoking, disease classification, fever and specific temperature, heart rate, clinical symptoms, blood oxygen saturation, outcome, lung CT results, routine biochemical indicators. Among of them, the classification of disease is based on the Seventh Edition COVID-19 diagnosis and treatment plan by the National Health Commission of the People's Republic of China, and the blood oxygen saturation value is measured on admission of hospital, what's more, biochemical indicators are the results within 24 hours after admission, and lung CT is the results of 3 days before and after admission, in addition, the body temperature is the highest temperature within 5 days before admission.

Definitions

Clinical classification

Light: The clinical symptoms were mild, and there was no sign of pneumonia on imaging. Common: It has respiratory symptoms, and the image shows pneumonia. Severe: 1. At rest, the respiratory rate ≥ 30 times/min. 2. At rest, the oxygen saturation $\leq 93\%$. 3. arterial partial pressure of oxygen(PaO₂) /fraction of inspired oxygen (FiO₂) ≤ 100 . Critical: 1. Respiratory failure and mechanical ventilation

required. 2. Shock symptoms clinically occurred. 3. Combined with other organ failure, ICU is needed for monitoring and treatment.

MuLBSTA score

The MuLBSTA score consists of multilobular infiltration (5 points), lymphopenia ≤ 0.8 (4 points), bacteria co-infection (4 points), smoking history (Acute-smoker 3 points, Quit-smoker 2 points), hypertension (2 points), and age ≥ 60 (2 points). If the patient has the above situation, calculate the score of each item and add it up[5].

Statistical analysis

We expressed continuous variables as the medians and interquartile ranges (IQR) or average. Categorical variables were presented as the counts. N represents the total number of people in each group. Kruskal-Wallis H test were applied to continuous variables. Chi square test is used to categorical variables. All data are analysed by spss software version 22.0. P values < 0.05 were considered significantly different.

Results

History characteristics

The enrolled 704 patients were affirmed infected with 2019-nCoV by the test of throat swabs. There are 334 men and 369 women, 48% and 52% respectively. More concretely, the number of female patients with light, normal, heavy and critical weight was 8 (2%), 291 (79%), 52 (14%), 18 (5%) respectively. Correspondingly, the number of male patients with light, normal, heavy and critical was 16 (5%), 234 (70%), 60 (18%) and 24 (7%) respectively. Gender is different in disease classification ($p < 0.05$). The research presented the age as median (IQR), and we know that as disease grades get more severe, the median age gets larger from 55.5(43.8–72.2) to 73.5(64.8–80.0). Comorbidities occurred in 60% of the patients, and the most common comorbidity was hypertension, followed by diabetes, coronary heart disease, COPD and cerebrovascular disease. Through analysis, we know that hypertension, chronic renal injury and cerebrovascular disease are different in the proportion of patients with different clinical types ($p < 0.05$), what's more, patients without comorbidities are in a lighter condition ($p < 0.05$). In terms of clinical symptoms, the frequency of occurrence was fever, dry cough, fatigue, chest tightness, dyspnea, poor appetite, and diarrhea. In addition, there were two cases of olfactory sense. In clinical symptoms, fever, dry cough, fatigue, chest distress, dyspnea, poor appetite and diarrhea were the most frequent. In addition, there were two cases of olfactory loss. Among them, dry cough, chest distress, dyspnea, asthenia, poor appetite and fever of different degrees are diverse in the frequency of disease classification ($p < 0.05$) (Table 1).

Table 1
Demographic, clinical, symptoms of patients with COVID-19 on admission

	Light(N = 24)	Common(N = 524)	Severe(N = 112)	Critical(N = 42)	P
Sex					0.036
Male	16	234	60	24	
Female	8	291	52	18	
Age. Year	55.5(43.8–72.2)	61.0(49.0–69.0)	67.0(54.8–75.0)	73.5(64.8–80.0)	< 0.001
Comorbidity					
Hypertension	8	150	45	23	0.001
Coronary heart disease	1	45	13	6	0.389
Diabetes	3	69	19	7	0.713
COPD	2	35	9	5	0.626
CKD	1	19	6	8	< 0.001
Cancer	0	9	3	1	0.804
CVD	3	27	8	8	0.003
None	9	213	43	10	< 0.001
Symptoms					
Fever	6	380	90	33	< 0.001
Highest temperature, °C					
< 37.3	18	144	22	9	< 0.001
37.3–38	4	129	28	15	
38.1–39	2	207	46	15	
> 39	0	44	16	3	
Dry cough	10	349	73	22	0.027
Chest tightness	1	118	37	9	0.012
Dyspnea	6	366	32	13	0.002

	Light(N = 24)	Common(N = 524)	Severe(N = 112)	Critical(N = 42)	P
Diarrhea	0	60	12	5	0.373
Olfactory deficiency	0	2	0	0	0.878
Fatigue	4	182	56	22	0.001
Poor appetite	0	58	20	12	0.001
Muscle soreness	0	31	9	2	0.479
None	10	20	1	0	< 0.001

Clinical examination features

On admission, the groups of leukocyte count below the normal range, above the normal range and in the normal range have distinct frequency in diverse disease levels ($p < 0.05$) (Table 2). Neutrophil count below the normal value in 81 patients (12%) and neutrophil count above the normal value in 622 patients (88%), but there is no obvious difference in the frequency of the two in different levels of disease ($p > 0.05$) (Table 2). As the severity of the disease increases, the median lymphocyte count decreases significantly ($p < 0.05$), and the lymphocyte count below the normal value to a certain extent indicates a serious condition (Table 2). Platelet count, hemoglobin, C-reactive protein, and D-Dimer median (IQR) also have significant difference in diverse disease levels ($p < 0.05$) (Table 2). The groups of blood routine index (ESR, Procalcitonin, AST, Creatinine, NT-proBNP, Troponin I) below the normal range and above the normal range also have significant difference in diverse disease levels ($p < 0.05$) (Table 2). In addition, similar to lymphocyte results, as the severity of the disease increases, the median albumin decreases significantly ($p < 0.05$). Through more detailed analysis, we know that different albumin content groups (< 25 , $25-30$, $30-35$, ≥ 35 g/L) have distinct frequency in diverse disease levels ($p < 0.05$) (Table 2). In CT imaging, nearly 97% of patients have ground glass opacity, and In addition, this study found that the frequency of pleural effusion in diverse disease levels was also different ($p < 0.05$).

Table 2
Laboratory, and radiographic findings of patients on admission.

	Light	Common	Severe	Critical	P
Leukocyte count (10 ⁹ /L)	6.4(5.7-8.0) (N = 24)	5.3(4.25–6.6) (N = 524)	5.7(4.2–7.8) (N = 112)	7.0(5.4–8.7) (N = 42)	< 0.001
< 4	1	107	26	1	< 0.001
4–10	21	403	73	34	
> 10	2	14	13	7	
Neutrophil count (10 ⁹ /L)	4.3(3.1–5.1) (N = 24)	3.3(2.5–4.3) (N = 524)	4.2(2.8–6.2) (N = 112)	5.7(4.5–7.7) (N = 42)	< 0.001
≤ 2	0	66	14	1	0.065
> 2	24	459	98	41	
Lymphocyte count (10 ⁹ /L)	1.6(1.0-2.1) (N = 24)	1.34(1.0-1.8) (N = 524)	0.9(0.7–1.1) (N = 112)	0.6(0.5-1.0) (N = 42)	< 0.001
< 1.1	8	182	78	32	< 0.001
≥ 1.1	16	343	34	10	
Platelet count (10 ⁹ /L)	206(179– 260) (N = 24)	230(174– 284) (N = 524)	211(145–271) (N = 112)	177(126–233) (N = 42)	< 0.001
Hemoglobin (g/L)	137(126– 144) (N = 24)	125(116– 137) (N = 524)	127(115–135) (N = 112)	123(91–140) (N = 42)	0.016
C-reactive protein (mg/L)	5.4(1.7–9.4) (N = 20)	5.7(2.7–23.2) (N = 490)	44.8(18.0- 83.6) (N = 103)	98.2(36.2– 122.0) (N = 40)	< 0.001
ESR (mm/h)	18.0(10.5– 20.0) (N = 11)	28.5(16.5– 48.0) (N = 246)	34.5(22.0- 59.5) (N = 42)	48.0(29.5– 70.5) (N = 16)	0.006
< 20	8	69	6	2	0.001
≥ 20	3	177	36	14	

	Light	Common	Severe	Critical	P
Procalcitonin (ng/mL)	0.02(0.02–0.05) (N = 23)	0.03(0.02–0.05) (N = 482)	0.06(0.04–0.13) (N = 93)	0.16(0.07–0.50) (N = 36)	< 0.001
< 0.05	17	320	30	2	< 0.001
≥ 0.05	6	162	63	34	
ALT (U/L)	19.5(13.8–25.5) (N = 24)	20.5(14.0–34.0) (N = 524)	26.0(15.8–43.5) (N = 112)	25.0(13.0–34.0) (N = 41)	0.071
< 40	21	420	80	34	0.125
≥ 40	3	104	32	7	
AST (U/L)	20.0(16.8–25.5) (N = 24)	23.0(18.0–31.0) (N = 524)	35.0(24.8–50.0) (N = 112)	35.0(23.0–60) (N = 41)	< 0.001
< 35	22	417	55	20	< 0.001
≥ 35	2	107	57	21	
Creatinine (umol/L)	69.1(57.5–82.3) (N = 24)	62.0(52.8–75.0) (N = 524)	68.75(57.7–82.1) (N = 112)	73.3(58.8–100) (N = 41)	< 0.001
< 81	17	424	81	25	0.003
≥ 81	7	100	31	17	
Albumin (g/L)	40.3(38.2–43.2) (N = 24)	36.2(32.9–39.0) (N = 524)	32.6(30.2–36.0) (N = 112)	28.8(27.1–32.7) (N = 41)	< 0.001
< 25	0	6	4	6	< 0.001
25–30	1	47	23	16	
30–35	2	155	52	14	
≥ 35	21	316	33	5	

	Light	Common	Severe	Critical	P
D-Dimer (mg/L)	0.24(0.14–1.61) (N = 17)	0.50(0.26–1.09) (N = 394)	0.92(0.48–2.70) (N = 86)	2.26(1.04–7.42) (N = 35)	< 0.001
Pro-BNP (pg/mL)	269(101–876) (N = 9)	109(42–263) (N = 220)	471(154–988) (N = 62)	1302(305–3041) (N = 18)	< 0.001
< 100	3	101	12	1	< 0.001
≥ 100	6	119	50	18	
Troponin I (ng/mL)	0.004 (0-0.007) (N = 9)	0.005 (0.002–0.010) (N = 166)	0.010 (0.004–0.034) (N = 60)	0.069 (0.022–0.307) (N = 25)	< 0.001
< 0.026	8	152	42	8	< 0.001
≥ 0.026	1	14	18	17	
Pleural effusion	2(24)	41(524)	31(112)	13(42)	< 0.001

Relationship between MuLBSTA and disease grade

As *Lingxi Guo* previously reported that MuLBSTA < 12 points represents low-risk and MuLBSTA ≥ 12 points means high-risk[5]. We further subdivided the 12 to 22 segments ($12 \leq \text{Mu} \leq 15$, $15 < \text{Mu} \leq 18$, $18 < \text{Mu} \leq 22$), and as the disease severity increases, the average value of MuLBSTA score obviously ascend ($p < 0.05$). Meanwhile, the research found that the groups of distinct MuLBSTA (< 12, 12–15, 15–18, 18–22) have remarkable difference in diverse disease levels ($p < 0.05$) (Table 3).

Table 3
Relationship between MuLBSTA and disease grade.

MuLBSTA	Light(N = 24)	Common(N = 524)	Severe(N = 112)	Critical(N = 42)	P
MuLBSTA score	3.7	9.3	12.1	15.0	< 0.001
Mu < 12	23	387	51	7	< 0.001
12 ≤ Mu ≤ 15	0	103	39	16	
15 < Mu ≤ 18	1	31	14	14	
18 < Mu ≤ 22	0	4	8	5	

In order to further explore the index that may need to be improved for the evaluation of novel coronavirus pneumonia by the MuLBSTA scoring system, and we studied the characteristics of the end point of death, clinical symptoms and laboratory examination of patients in different MuLBSTA groups. First of all, the established model, MuLBSTA scoring system, has effectively predictive ability for death ($p < 0.05$), simultaneously, the study recovered that whether fatigue or poor appetite was different in distinct groups of MuLBSTA (< 12 , $12-15$, $15-18$, $18-22$) ($p < 0.05$), while whether fever, dry cough, chest tightness, dyspnea were not significantly different in diverse groups of MuLBSTA ($p > 0.05$). Therefore, in terms of clinical symptoms, fatigue or poor appetite can be considered to be included in the index for the improved version of MuLBSTA (Table 4). In biochemical examination, the research noticed that a few of tests median value (C-reactive protein, Albumin, D-Dimer, NT-proBNP) becomes lower and lower as the MuLBSTA score gets higher and higher, which also indicates that the tests (C-reactive protein, Albumin, D-Dimer, NT-proBNP) may be required to improve the MuLBSTA scoring system (Table 4).

Table 4
Indicators that may need to be supplemented by the MuLBSTA scoring system.

MuLBSTA score	Mu < 12	12 ≤ Mu ≤ 15	15 < Mu ≤ 18	18 < Mu ≤ 22	p
Clinical symptoms	(N = 468)	(N = 158)	(N = 60)	(N = 17)	
No fever	140	36	13	5	0.243
Fever	328	122	47	12	
Poor appetite	49	26	13	2	0.038
No	419	132	47	15	
Fatigue	169	55	29	11	0.026
No	299	103	31	6	
Dry cough	291	110	42	11	0.295
No	177	48	18	6	
Chest tightness	114	35	13	3	0.852
No	354	123	47	14	
Dyspnea	85	27	14	7	0.080
No	383	131	46	10	
Biochemical test					
C-reactive protein (mg/L)	4.7(2.5–18.7) (N = 438)	28.2(8.1–63.8) (N = 141)	72.5(24.0–105.7) (N = 57)	75.4(59.3–124.9) (N = 16)	< 0.001
Albumin (g/L)	36.5(33.3–39.6) (N = 467)	33.7(30.5–36.7) (N = 157)	30.8(28.7–34.5) (N = 59)	27.4(24.6–31.4) (N = 17)	< 0.001
D-Dimer (mg/L)	0.45(0.25–1.04) (N = 353)	0.83(0.42–1.77) (N = 115)	1.1(0.66–2.80) (N = 50)	1.44(0.59–9.36) (N = 15)	< 0.001
Pro-BNP (pg/mL)	105(35–261) (N = 185)	237(90–751) (N = 84)	441(210–734) (N = 35)	1298(987–2226) (N = 8)	< 0.001
Dead or not	(N = 468)	(N = 158)	(N = 60)	(N = 17)	
Dead	4	16	9	5	< 0.010

MuLBSTA score	$\text{Mu} < 12$	$12 \leq \text{Mu} \leq 15$	$15 < \text{Mu} \leq 18$	$18 < \text{Mu} \leq 22$	p
No	464	142	51	12	

Discussion

This is a retrospective study on the clinical features of COVID-19 and the MuLBSTA scoring system, including 703 patients of COVID-19 from Wuhan forth hospital.

Clinically, we found that some patients with COVID-19 have mild or no symptoms, but they have the same infectivity[6]. At the same time, they also have the possibility of transforming into severe cases, which is the difficulty of our epidemic prevention and treatment, so it is particularly important to preliminarily determine the patient's condition change through the disease state at the time of admission. Therefore, we studied the most serious level of the disease course and the patient's basic situation, clinical symptoms, biochemical examination, etc., and also evaluate the MuLBSTA evaluation system prediction for the most severe state of the patient's disease course, and the indexes that may need to be improved are also discussed. Studies have shown that COVID-19 has more male patients than female patients[1], and a research reported that gender related ratios of COVID-19 patients were similar[7]. Among the patients with the novel coronary pneumonia we included, men accounted for 48% and women accounted for 52%, and the difference between the two genders was small, but the proportions of the two in diverse disease levels were distinct, specifically, there are more male critically ill patients. This may be related to the X chromosome and sex hormones, which exert a vital role in innate and adaptive immunity[8], or it may be related to smoking. Our data show that novel coronavirus pneumonia is usually more severe in older patients, which is the same as others[9, 10]. Novel coronavirus pneumonia patients with other comorbidity are relatively severe, and thirty-two percent of them with hypertension, what's more, we also found that patients with hypertension are more likely to develop severe and critical diseases[5]. Chronic kidney injury is also the same, and many dead patients have renal failure, meanwhile, acute kidney injury during novel coronavirus pneumonia course indicates poor prognosis and increases mortality[11]. Correspondingly, there was no obviously difference in the proportion of coronary heart disease, diabetes mellitus, COPD and cancer in diverse disease levels. Thus it may be known, we need to be particularly vigilant for patients of novel coronary pneumonia complicated with hypertension and kidney injury. From the analysis of clinical symptoms, fever is commonly found in the patients with severe and critical illness. The proportion of fever in the patients with severe illness is as high as 80%. Meanwhile, dry cough, chest distress, dyspnea, fatigue and poor appetite are also more common in the patients with severe and critical illness.

According to the analysis of the laboratory examination results of patients at admission, there are significant differences in many blood examination indexes among patients with diverse grades of diseases (Leukocyte count, Neutrophil count, Lymphocyte count, Platelet count, Hemoglobin, C-reactive protein, ESR, Procalcitonin, Creatinine, Albumin, D-Dimer, D-Dimer, Troponin I). Although there are

differences is hard to distinguish clinically, and the exceptions are lymphocyte count, C-reactive protein, ESR, Albumin, D-Dimer, NT-proBNP, which results are similar to other research results[12–15].

Contradictory to the previous research showing that pleural effusion has no specific type in patients with novel coronary pneumonia[16], the study found that severe patients are more likely to develop pleural effusion. The main reason is that the sample size of the previous study is too small.

The MuLBSTA score consists of multilobular infiltration, lymphopenia ≤ 0.8 , bacteria co-infection, smoking history, hypertension, and age ≥ 60 , and these data are very easy to obtain clinically. Intuitively, the MuLBSTA score is getting higher and higher with the severity of the disease, in addition, we found that the MuLBSTA score of moderate and severe diseases was more than 12 points, which was similar to the initial study of MuLBSTA[5], We also found that the difference of MuLBSTA score in distinct disease grades was significant. The higher the MuLBSTA score, the more serious the disease was, but there were 58 serious patients with MuLBSTA score less than 12 points in the data, which also deserves our attention. According to the analysis, the cause of this phenomenon is the inaccurate record of smoking history in case data, or the congenital deficiency of MuLBSTA scoring system. For the first reason, we can strengthen the inquiry and record of smoking history, and for the second reason, we need to consider the evaluation indicators that MuLBSTA may need to improve. Next, we make more efforts to this goal in depth analysis.

Considering that the index of MuLBSTA scoring system does not involve clinical symptoms, we try to analyze the possible symptom indexes. We included six symptoms, namely fever, poor appetite, fatigue, chest tightness, dyspnea and dry cough, and we discovered that only poor appetite and fatigue were diverse in MuLBSTA score segment, which represents that poor appetite and fatigue are likely to be selected as symptom indicators. In addition, there may be some indexes that need to be improved in terms of laboratory examination indexes. We know that the MuLBSTA scoring system includes a laboratory examination index-lymphocyte count. Are there any other examination indexes that can be included? We selected some indexes with significant distinct in the values of various disease grade (CRP, albumin, D-dimer, pro BNP). Our analysis showed that the indicates-CRP, albumin, D-dimer, NT-proBNP, which are MuLBSTA may need to include. Because of the limited number of cases in our single center study, the above conclusions need to be confirmed by more extensive studies.

Conclusion

For this single-center retrospective study, the analysis displayed that to some extent, we can predict the development trend of patients' diseases from the state of admission. From the perspective of patient classification, patients over 60 years old with basic diseases, especially hypertension, chronic renal injury and cerebrovascular disease, are the high-level group of patients with high risk of serious illness. From the symptom analysis-fever over 38 degrees, dyspnea, fatigue, poor appetite-may indicate that the disease will develop into severe or critical illness. According to the results of the examination, lymphopenia, high CRP, high ESR, bacterial infection, low albumin, high D-dimer, high pro BNP and pleural

score, the more serious the disease was, and we need to be alert to patients with high MuLBSTA scores. Of course, the evaluation of MuLBSTA for novel coronavirus pneumonia patients are not irrefragable, further, poor appetite, fatigue and some abnormal laboratory test results may be new indicators to be included.

Declarations

Funding

This study was supported by the Hubei Province Health and Family Planning Scientific Research Project to XiaoyunZeng. (WJ2019M021)

Disclosure Statement

The authors declare no conflicts of interest. All data generated or analysed during this study are included in this published article. The study was approved by Wuhan Fourth Hospital Ethics Committee.

Authors' contributions

XiaoyunZeng and Chao Wang designed the study and undertook most of the work. The other authors are responsible for data collection and analysis. The authors read and approved the final manuscript.

References

1. Zhang G, Zhang J, Wang B, Zhu X, Wang Q, Qiu S. Analysis of clinical characteristics and laboratory findings of 95 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a retrospective analysis. *Respir Res.* 2020;21(1):74.
2. Wang Z, Yang B, Li Q, Wen L, Zhang R. Clinical Features of 69 Cases with Coronavirus Disease 2019 in Wuhan, China. *Clin Infect Dis*, 2020.
3. Shi F, Yu Q, Huang W, Tan C. 2019 Novel Coronavirus (COVID-19) Pneumonia with Hemoptysis as the Initial Symptom: CT and Clinical Features. *Korean J Radiol*, 2020.
4. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet.* 2020;395(10223):507–13.
5. Guo L, Wei D, Zhang X, Wu Y, Li Q, Zhou M, Qu J. Clinical Features Predicting Mortality Risk in Patients With Viral Pneumonia: The MuLBSTA Score. *Front Microbiol.* 2019;10:2752.
6. Meng H, Xiong R, He R, Lin W, Hao B, Zhang L, Lu Z, Shen X, Fan T, Jiang W, et al., CT imaging and clinical course of asymptomatic cases with COVID-19 pneumonia at admission in Wuhan, China. *J Infect*, 2020.
7. Zhang G, Hu C, Luo L, Fang F, Chen Y, Li J, Peng Z, Pan H. Clinical features and short-term outcomes of 201 patients with COVID-19 in Wuhan, China. *J Clin Virol.* 2020;127:104364.

8. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *The Lancet*. 2020;395(10223):507–13.
9. Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H, Wu Y, Zhang L, Yu Z, Fang M, et al., Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *The Lancet Respiratory Medicine*, 2020.
10. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, Xiang J, Wang Y, Song B, Gu X, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The Lancet*. 2020;395(10229):1054–62.
11. Fanelli V, Fiorentino M, Cantaluppi V, Gesualdo L, Stallone G, Ronco C, Castellano G. Acute kidney injury in SARS-CoV-2 infected patients. *Crit Care*. 2020;24(1):155.
12. Zhou Y, Zhang Z, Tian J, Xiong S. Risk factors associated with disease progression in a cohort of patients infected with the 2019 novel coronavirus. *Ann Palliat Med*. 2020;9(2):428–36.
13. Zheng F, Tang W, Li H, Huang YX, Xie YL, Zhou ZG. Clinical characteristics of 161 cases of coronavirus disease 2019 (COVID-19) in Changsha. *Eur Rev Med Pharmacol Sci*. 2020;24(6):3404–10.
14. Liu W, Tao ZW, Lei W, Ming-Li Y, Kui L, Ling Z, Shuang W, Yan D, Jing L, Liu HG, et al., Analysis of factors associated with disease outcomes in hospitalized patients with 2019 novel coronavirus disease. *Chin Med J (Engl)*, 2020.
15. Cui S, Chen S, Li X, Liu S, Wang F. Prevalence of venous thromboembolism in patients with severe novel coronavirus pneumonia. *J Thromb Haemost*, 2020.
16. Yang H, Sun G, Tang F, Peng M, Gao Y, Peng J, Xie H, Zhao Y, Jin Z. Clinical Features and Outcomes of Pregnant Women Suspected of Coronavirus Disease 2019. *J Infect*, 2020.

Figures

Figure 1.

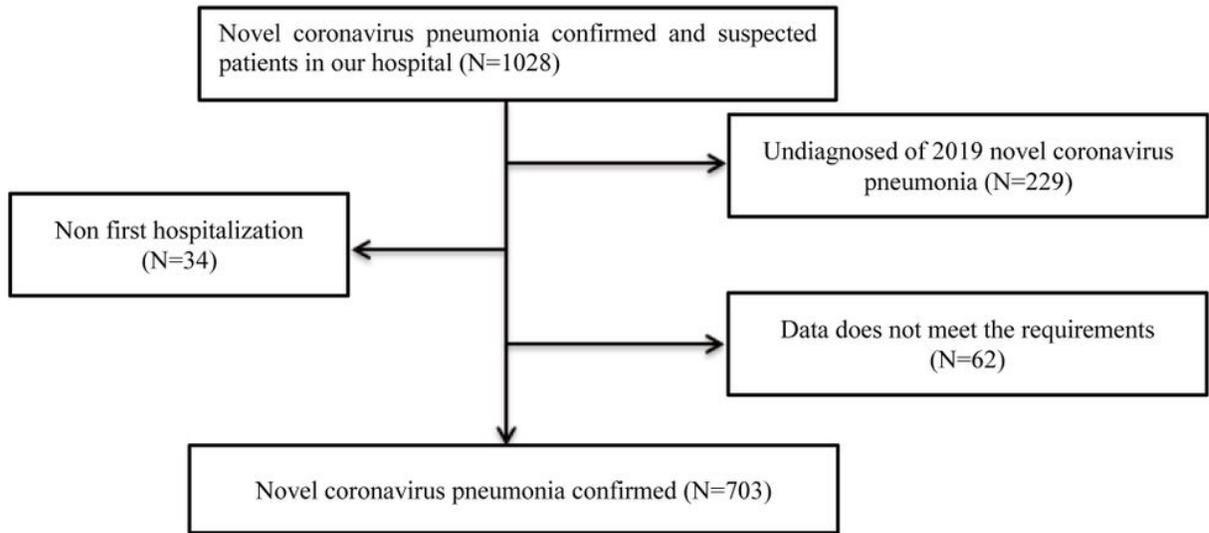


Figure 1

Research flow chart, a total novel coronavirus pneumonia study was conducted in 1028 patients. 229 (22.3%) patients were not able to diagnose new crown pneumonia, and 34 (3.3%) were not first hospitalized patients, and 62 (6.0%) patients were not well informed. Finally the study included 703 (68.4%) patients.