The Analysis of Clinical Characteristics and Its Early Warning Indicators under the Severe and Dead Patients with COVID-19

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Abstract: In December 2019, New Coronary Pneumonia (COVID-19) broke out in Wuhan, China. Subsequently, New Coronary Pneumonia broke out to varying degrees throughout the country. Over time, more and more deaths have appeared in various places, providing the possibility of studying death cases. So this article has put forward about 60 severely ill patients who appeared in Henan province. It was divided into a severe death group and a severe discharge group. According to the clinical indicators at the time of admission, which indicators were used as early warning indicators, the clinical outcome of severe patients was estimated in advance.

Since December 2019, Wuhan City, Hubei province has reported cases of unexplained pneumonia. On January 7, 2020, the virus typing was identified as a novel coronavirus pneumonia (Novel Coronavirus Pneumonia, NCP) [1]. New coronavirus pneumonia (referred to as "new coronary pneumonia") has a wide spread and strong pathogenicity, and its main transmission route is through respiratory droplets and close contact transmission [2]. As of 24:00 on April 30, there were 599 confirmed cases; a total of 77642 cases were cured and discharged, 4633 cases were dead, and 82874 cases were reported [3].

The subjects studied in this article are those severely ill patients with COVID-19 in Henan province, and their clinical outcomes were either cured or dead. Those patients who are still being treated in hospitals are not included in this study. This article summarizes the clinical indicators of different groups, finds indicators with significant differences, uses the ROC curve to find the critical value, then groups each variable, and then builds a logistic regression model and calculates the OR value.

1. Data collection and statistical methods

1.1 Collection of data This study collected electronic medical records of severe ill patients with new coronary pneumonia who were discharged or died in designated hospitals in Henan Province as of February 18th, and screened cases that met the research criteria according to the inclusion and exclusion criteria. The exclusion criteria are: 1. Excluding the cases with too many missing results from the first examination. 2. Screening out the critically ill patients who are still being treated in hospitals. After this screening, we collected information such as the patient's name, gender, and symptoms of the patient on admission.

1.2 Statistical methods Firstly, design the questionnaire according to the research needs, and then collect data. After the collection, use SPSS19.0 software for analysis. The Mann-Whitney U test was used to determine which indicators were significantly different between the two groups. We finally chose age, white blood cell count, lymphocyte percentage, and C-reactive protein as meaningful single factors. Then use the ROC curve to find the critical value for dividing into binary variables, and then convert the remaining variables into binary variables. Finally, find the logistic regression formula and calculate the OR value.

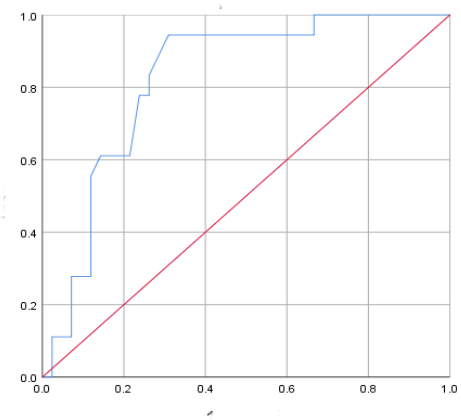
2. The result

We can see from the P value that only age, white blood cell count, lymphocyte percentage, and C-reactive protein are meaningful. See table 1

Table 1. Basic information and clinical features of patients with new coronary pneumonia

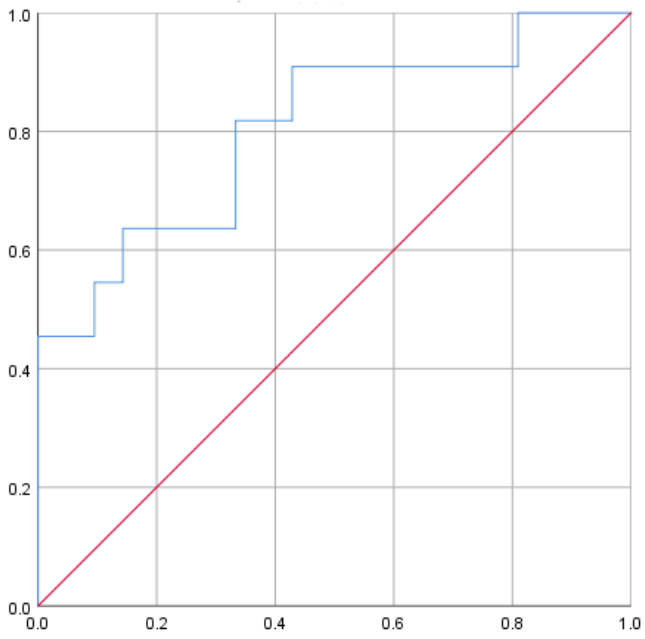
Index	Median		
	Severe improvement group	Severe death group	P
Gender			
Male	26（61.9%）	12（66.7%）	——
Female	16（38.1%）	6（33.3%）	——
Age	40.58±12.33	68.74±12.18	0.000
Blood routine			
White blood cell count（10^9/L）	4.29（3.49-5.56）	6.98（4.28-11.82）	0.003
Red blood cell count（10^12/L）	4.74±0.52	4.27±0.52	0.553
Platelet count（10^9/L）	185.27±47.68	169.73±84.31	0.433
Lymphocyte absolute value（10^9/L）	1.00（0.81-1.31）	0.87（0.49-1.43）	0.440
Lymphocyte percentage（%））	26.58±11.69	17.48±14.18	0.03
liver function			
Total bilirubin（μmol/L）	9.95（5.88-16.67）	11.35（6.18-17.51）	0.840
Direct bilirubin（μmol/L）	3.35（2.72-5.20）	4.70（3.10-7.62）	0.143
Indirect bilirubin（μmol/L）	7.84±4.93	6.69±5.10	0.519
Renal function			
Creatinine（μmol/L）	66.20（53.43-71.00）	70.00（56.93-85.00）	0.285
C-reactive protein（mg/L）	30.52（15.83-89.42）	68.00（24.94-100）	0.010

The AUC of each variable selected according to the P value is shown below, and all are greater than 0.5. See Figure 1-4, and Table 2.



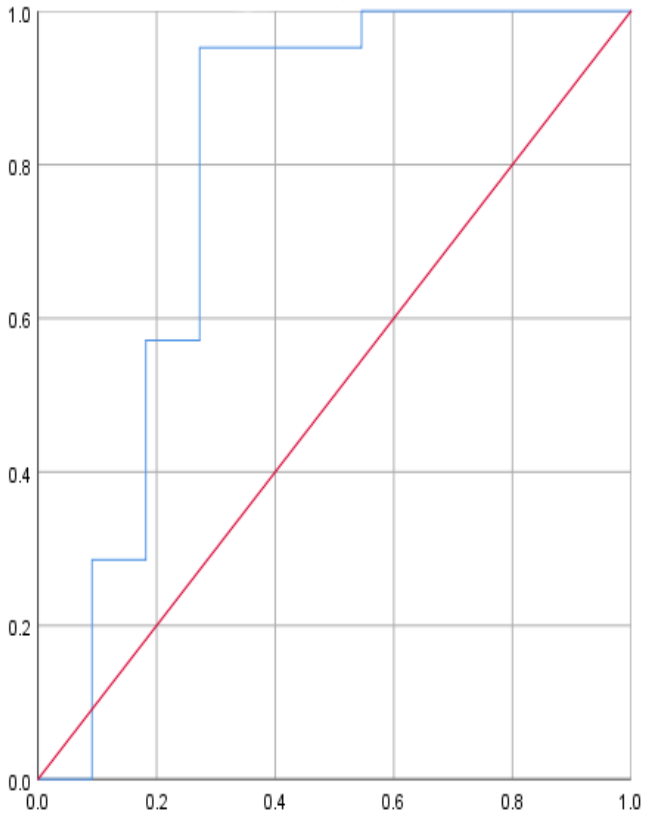
FALSE POSITIVE RATE

Figure 1. Age ROC curve



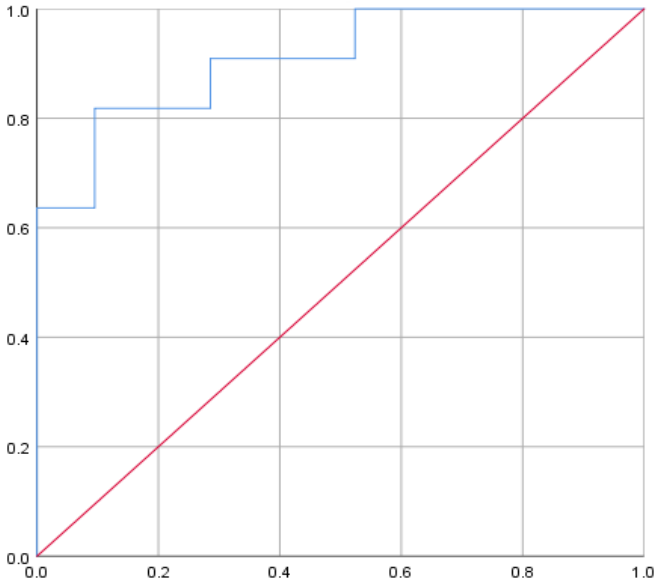
FALSE POSITIVE RATE

Figure 2. ROC curve of white blood cell count



FALSE POSITIVE RATE

Figure 3. ROC curve of lymphocyte percentage



FALSE POSITIVE RATE

Figure 4. C-reactive protein ROC curve

Table 2. ROC curve analysis table

Index	Critical value	AUC(95%CI)	Youden Index	*P*
Age（Time）	63.50	0.824（0.716,0.932）	0.634	0.000
White blood cell count	5.34	0.805（0.673,0.973）	0.493	0.005
C - Reactive protein	27.85	0.909(0.799,1.000)	0.723	0.000
Lymphocyte percentage	17.60	0.792(0.588,0.996)	0.679	0.007

After determining the more sensitive factors, we convert these variables into binary classification variables and put them into logistic regression, and calculate the OR value. From the perspective of the risk of death of patients, those patients who were older than 63.50 years are 37.0 times than the patients below 63.5 years old, and those whose lymphocyte percentage is less than 17.60% are 5.9 times greater than 17.60%. C-reactive protein higher than 27.85mg/L is 6.8 times lower than 27.85mg/L. See table 3

Table 3. Logistic regression model analysis

Index	b	SE	OR(95%CI)	*P*
Age≥63.5Time	3.611	1.451	37.013（5.371~387.912）	0.007
Lymphocyte percentage<17.6%	1.777	0.631	5.911（1.258~20.421）	0.045
C-reactive protein≥27.85mg/L	1.919	0.071	6.812（1.763~63.561）	0.025

Discussions

In summary, age, percentage of lymphocytes, and C-reactive protein can be used as independent factors to distinguish between severe death group and severe improvement group. For the age factor, 63.5 years old is used as the critical value. And through logistic regression analysis, the OR value of age is 37.0, which means that from the perspective of the risk of death, the age greater than 63.50 years is 37.0 times the age less than 63.5 years. According to previous research, among the

hospitalized cases of new coronary pneumonia, the patients with older age usually have more severe cases. From this we infer that the higher the age, the greater the number of deaths. [4]

At the same time, the clinical observation of patients with new coronary pneumonia, especially severe patients, significantly reduced lymphocyte count [5]. Then according to the conclusion drawn in this article, the percentage of lymphocytes less than 17.60% is 5.9 times greater than above 17.60%. We can deduce that as the condition gets worse, the patient's lymphocyte count will get lower and lower. Therefore, the percentage of lymphocytes in the severe death group is significantly lower than the severe improvement group.

In addition, the results of the study also show that from the perspective of the risk of death of patients, C-reactive protein which is higher than 27.85mg/L is 6.8 times lower than 27.85mg/L. As an acute phase inflammatory response protein, C-reactive protein is associated with an increased risk of organ failure and death, and a continuously elevated C-reactive protein is associated with a poor prognosis [6]. The increase of C-reactive protein indicates the aggravation of the patient's condition. Therefore, we speculate that the C-reactive protein of deceased patients is higher than that of severely cured patients in the initial detection.

However, this study also has many shortcomings, for example, the sample size is too small, so that in order to avoid inaccurate logistic regression, only a small number of variables can be selected for analysis, which greatly limits this study.

This study summarizes the characteristics of the new coronary pneumonia indicators, and analyzes which indicators can be used as early warning indicators during the initial admission examination, so that in the future, when clinicians meet patients with new coronary pneumonia, these indicators can be used to initially screen out possible death patients, and use targeted treatment for them.

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