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Retrospective Study

Analysis of clinical characteristic differences and risk factors between elderly patients with severe and non-severe Omicron SARS-CoV-2 variant infection

Analysis of Omicron variant infection

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Abstract

BACKGROUND

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has caused millions of confirmed cases and deaths worldwide. Elderly patients are at higher risk of contracting and dying from COVID-19 due to advanced age, decreased immune function, intense inflammatory response, and comorbidities. Shanghai has experienced a wave of infection with Omicron, a new variant of SARS-CoV-2, since March 2022. There is a pressing need to identify the clinical features and risk factors in disease progression among elderly patients with Omicron infection to provide solid evidence for clinical policymakers, public health officials, researchers, and the general public.

AIM

To investigate the clinical characteristic differences and risk factors between elderly patients with severe and non-severe Omicron SARS-CoV-2 variant infection.

METHODS

A total of 328 elderly patients with COVID-19 admitted to the Ninth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine from April 2022 to June 2022 were enrolled and divided into a severe group (82 patients) and a non-severe group (246 patients) according to the diagnosis and treatment protocol of COVID-19 (version 7). The clinical data and laboratory results of both groups were collected and compared. A Chi-square test, *t* test, Mann–Whitney U test, hierarchical log-rank test, univariate and multivariate logistic regression, and hierarchical analyses were used to determine statistical differences.

RESULTS

The severe group was older (84 vs. 74 years, $P < 0.001$), included more males (57.3% *vs* 43.9%, $P = 0.037$), had a lower vaccination rate ($P < 0.001$), and had a higher proportion of comorbidities including chronic respiratory disease ($P = 0.001$), cerebral infarction ($P < 0.001$), chronic kidney disease ($P = 0.002$), and neurodegenerative disease ($P < 0.001$) than the non-severe group. In addition, severe patients showed a higher inflammatory index ($P < 0.001$), higher demand for symptomatic treatment ($P < 0.001$), longer hospital stay ($P = 0.011$), extended viral shedding time ($P = 0.014$), and higher mortality than non-severe patients ($P < 0.001$). No difference was observed in the application of Paxlovid in severe and non-severe patients ($P = 0.817$). Oxygen saturation, cerebral infarction, and D-dimer were predictive factors for developing a severe infection in patients with COVID-19. D-dimer had an excellent role in identifying severe infection (AUC: 90.1%, 95%CI 86.1–94.0%). In addition, according to the multivariate stratified analysis, D-dimer was a risk factor for developing severe COVID-19 infection.

CONCLUSION

The clinical course of severe COVID-19 is complex, with a higher need for symptomatic treatment. D-dimer is a suitable biomarker for identifying patients at risk for developing severe COVID-19 infection.

Key Words: COVID-19; Omicron; severe infection; elderly patients; clinical features; risk factor

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Core Tip: Since March 2022, the Omicron wave has affected Shanghai, China. Many elderly patients with severe and non-severe Omicron SARS-CoV-2 variant infection have been admitted to our hospital. These patients have a precise diagnosis, complete examination, and clear treatment results. After China adjusts its coronavirus prevention and control policies in 2023, findings like those in this article will no longer be available.

INTRODUCTION

Currently, coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has caused millions of confirmed cases and deaths around the world. As of 6:32pm Central European Time, September 27 2023, there were 770,875,433 confirmed cases of COVID-19 globally, including 6,959,316 deaths, reported to the WHO[1].

SARS-CoV-2 not only affects the respiratory tract, causing pneumonia, but it can also affect the gastrointestinal tract, nervous system, or cardiovascular system[2,3]. The severity of symptoms in COVID-19 patients also varies from asymptomatic to life-threatening[4]. Across all age groups, elderly patients, defined as 60 years of age or older, are at higher risk of contracting and dying from COVID-19[5,6]. In a multicenter study in the Netherlands, the in-hospital mortality of older hospitalized patients with COVID-19 was 38%[7]. From the perspective of epidemic transmission, in long-term care centers, many older people with disabilities and severe cardiovascular and neurological diseases live together in close contact, which facilitates the transmission of the virus and

leads to infection and progression of severe COVID-19 in the elderly [8,9]. Based on the analysis of global COVID-19 data, it was concluded that the causes of severe illness in elderly infected patients are closely related to their advanced age, decreased immune function, intense inflammatory response in the body, and comorbidities of the patients. In previous studies, hypertension, atrial fibrillation, type 2 diabetes, chronic respiratory disease, dementia, and depression were associated with hospitalization rates and mortality in elderly patients with COVID-19 [10-12].

Previous studies have shown that excessive inflammation, cytokine storm, and coagulopathy are important pathological mechanisms of COVID-19[13,14]. The neutrophil-to-lymphocyte ratio (NLR) reflects the systemic inflammatory response and the level of neutrophil-to-lymphocyte activation. The systemic inflammatory response index (SIRI) may also reflect the host's immune and inflammatory balance [15]. The white blood cell count, neutrophil percentage, C-reactive protein (CRP), procalcitonin (PCT), D-dimer, and lactate were closely related to the severity and mortality of COVID-19[16-19].

Shanghai has experienced a wave of infection with Omicron, a new variant of SARS-CoV-2, since March 2022. The Omicron variant, which was first identified in Botswana and South Africa in November 2021, accounted for 41% of all strains by August 20, 2022[20]. Omicron includes several subvariants, including BA.1, BA.2, BA.3, BA.4, and BA.5, all of which have a high transmission rate and significant antibody avoidance, posing a great threat to the prevention and control of COVID-19[21-23]. This study retrospectively analyzed baseline clinical features and risk factors of older patients with severe and non-severe COVID-19 Omicron infection to provide solid evidence for clinical policymakers, public health officials, researchers, and the general public; help identify high-risk groups; and promote appropriate remediation.

MATERIALS AND METHODS

2. Materials and methods

2.1 Subjects

The clinical data of 328 elderly patients diagnosed with COVID-19 and admitted to the Ninth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine from April 2022 to June 2022 were collected during hospitalization. The diagnosis of confirmed COVID-19 infection was based on the positive results of a nasopharyngeal swab sample tested by real-time reverse transcription polymerase chain reaction (RT-PCR) using SARS-CoV-2 ZC-HX-201-2 kit (Biogerm, Shanghai, China). Elderly patients were defined as those diagnosed at age 60 or older[6]. Discharge criteria for patients including (1) body temperature is back to normal for more than 3 days; (2) respiratory symptoms improve obviously; (3) pulmonary imaging shows obvious absorption of inflammation; (4) Nuclei acid tests negative twice consecutively (sampling interval being at least 24 h)[24].

In this study, 15 people died, comprising 0 non-severe patients and 15 severe patients, and the direct cause of death was the comorbidity. This study was approved by the Ethics Committee of the Ninth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine (Ethics Approval No.: SH9H-2022-T139-1).

2.2 Methods

Baseline data, vaccination status, onset time, onset symptoms, viral shedding time, comorbidities, laboratory data, therapeutic drugs, length of hospitalization, and survival of 328 elderly patients with COVID-19 were collected. Laboratory tests included blood routine tests, CRP, PCT, coagulation function, liver function, cytokines, lactic acid, and other indicators. According to the discharge diagnosis and clinical data during hospitalization, the study was divided into mild, general, severe, and critical severe types according to the clinical classification criteria of the novel coronavirus pneumonia diagnosis and treatment protocol (Trial version 7)[24]: (1) mild type: fever and cough, nasal stuffiness, and other respiratory tract clinical symptoms are mild; no imaging manifestations of pneumonia; (2) general type: with the above clinical manifestations and imaging manifestations of pneumonia; (3) severe: conformed to any of the following articles, including i) appeared shortness of breath, respiratory frequency acuity 30 times/min; ii) the oxygen saturation being 93% or less in the resting

state; iii) arterial blood oxygen partial pressure ≤ 300 mmHg or less oxygen concentration (1 mmHg = 0.133 kPa); and iv) the clinical symptoms progressively worsened, and lung imaging showed lesions that progressed significantly more than 50% within 24–48 h; (4) critical severe: cases meeting any of the following criteria: i) respiratory failure and requiring mechanical ventilation; ii) shock; iii) with other organ failure that requires ICU care.

Among the 328 elderly patients in this study, mild and general types were included in the non-severe group (246 cases in total), and severe and critical severe types were included in the severe group (82 cases in total). The baseline data at admission, differences in mortality risk, and risk factors for developing a severe infection of patients in the severe and non-severe groups were analyzed retrospectively to verify the ability and clinical significance of using laboratory indicators to identify severe infection.

3. Statistical method

SPSS Software 25.0 (SPSS Inc., Chicago, USA) was used for statistical analysis. Measurement data with skewed distribution are represented by median (interquartile range), while measurement data with normal distribution or approximate normal distribution are represented by mean ± standard deviation. The Chi-square test or Fisher exact probability test and t test and the Mann–Whitney U test were used for comparison between groups. The count data is expressed as the number of cases (percentage). The risk accumulation curve was calculated using a stratified log-rank test, univariate, and multivariate analysis using logistic regression analysis, and the receiver operator characteristic curve (ROC) was used to analyze and calculate the area under the curve (AUC). The optimal critical value of D-dimer and the corresponding sensitivity and specificity were calculated. The layered analysis was drawn by GraphPad 8.0 (GraphPad Software, San Diego, CA, USA). All tests were bilateral. A $P < 0.05$ was considered statistically significant.

RESULTS

4. Results

4.1. Comparison of general data between severe and non-severe COVID-19 patients

Among the 328 patients with COVID-19, 155 were males and 173 were females, with a median age of 77 (68, 86) years. The severe infection group was older than those without severe infection (84 vs. 74 years, $P < 0.001$), had more males (57.3% *vs* 43.9%, $P = 0.037$), and had lower vaccination rates ($P < 0.001$). In terms of comorbidities, severe patients had higher rates of chronic respiratory disease ($P = 0.001$), cerebral infarction ($P < 0.001$), chronic kidney disease ($P = 0.002$), and neurodegenerative disease ($P < 0.001$) than non-severe patients, and the difference was statistically significant. In terms of symptoms, the severe group had more patients with fever ($P < 0.001$), cough ($P < 0.001$), nasal stuffiness ($P = 0.026$), and other symptoms (including impaired smell, poor appetite, and nausea) than the non-severe group ($P < 0.001$). In terms of disease severity, the inflammatory indicators SIRI, NLR, TNF-a, IL-10, IL-1, PCT, CRP, WBC, neutrophil percentage, lactic acid, and D-dimer in severe patients were significantly higher than those in non-severe patients ($P < 0.001$). The glomerular filtration rate in severe patients was lower than that in non-severe patients, and the difference was statistically significant ($P = 0.039$). Severe patients had significantly higher demands for respiratory support, glucocorticoids, anticoagulation (low molecular weight heparin or ordinary heparin), and antibiotics than non-severe patients ($P < 0.001$). The application of Lianhua Qingwen granules in severe patients was significantly lower than that in non-severe patients ($P = 0.007$). There was no difference in the application of Paxlovid in severe and non-severe patients ($P = 0.817$). The length of hospitalization ($P = 0.011$) and virus shedding time ($P = 0.014$) in severe patients were higher than those in non-severe patients, and the difference was statistically significant. In terms of clinical outcome, the number of deaths was 15, among which the mortality rate of non-severe patients was 0%, and that of severe patients was 18.29%. The mortality rate of severe patients was significantly higher than that of non-severe patients ($P < 0.001$) (Table 1).

In this study, the viral shedding time of severe and non-severe patients was 10.95 ± 7.74 and 8.65 ± 4.87 days, respectively. During the viral shedding period, a total of 15 patients died, all of whom were severe COVID-19 patients. The cumulative incidence of death risk during viral shedding was higher in severe patients than in non-severe patients (log-rank test = 36.286, $P < 0.001$) (Figure 1).

4.2. Univariate and multivariate analysis of the development of severe infection in elderly patients with COVID-19

Univariate and multivariate logistic regression were used to analyze the risk factors for developing a severe infection in COVID-19 patients (Table 2). In univariate regression analysis, only oxygen saturation (OR: 0.513, 95% CI, 0.369–0.714; $P < 0.001$) was a risk factor for developing a severe infection in patients with COVID-19. In multivariate logistic regression analysis, oxygen saturation (OR: 0.573, 95% CI, 0.451–0.728; $P < 0.001$), cerebral infarction (OR: 4.26, 95% CI, 1.012–17.937; $P = 0.048$), and D-dimer (OR: 1.394, 95% CI, 1.000–1.944; $P = 0.05$) were predictors of severe infection in patients with COVID-19 infection.

4.3. ROC curve analysis of elderly patients with severe COVID-19

A ROC curve was used to analyze and calculate the AUC of neutrophil percentage, CRP, D-dimer, NLR, SIRI, lactic acid, white blood cell count, and PCT indicators to test the ability of each indicator to identify severe infection in elderly patients with COVID-19. Among them, the AUC of neutrophil percentage was 0.895, CRP was 0.900, NLR was 0.883, SIRI was 0.854, lactic acid was 0.764, white blood cell count was 0.775, and PCT was 0.871. The AUC of D-dimer was 0.901 ($P < 0.001$). When the threshold was 1.020 mg/L, the AUC was 90.1% (95%CI 86.1–94.0%). The sensitivity and specificity of D-dimer to identify severe infection in elderly patients with COVID-19 were 85.5% and 81.7%, respectively (Figure 2).

4.4. Multivariate stratified analysis of D-dimer levels in elderly patients with COVID-19

Figure 3 is a multivariate stratified analysis of D-dimer levels in elderly patients with COVID-19. Overall, D-dimer is a risk factor for the development of severe infection in elderly patients with COVID-19 (OR = 1.839, $P < 0.001$). In a further variable stratification analysis, D-dimer remained a risk factor for the development of severe infection in elderly patients with COVID-19, including female patients (OR = 1.621, $P < 0.001$), male patients (OR = 2.288, $P < 0.001$), patients younger than the median age of 77 years (OR = 2.506, $P < 0.001$), patients older or equal to 77 years old (OR = 1.583, $P < 0.001$), patients not vaccinated against COVID-19 (OR = 1.702, $P < 0.001$), patients not vaccinated against COVID-19 (OR = 3.148, $P = 0.006$), patients without chronic respiratory disease (OR = 1.771, $P < 0.001$), patients with chronic respiratory disease (OR = 11.525, $P = 0.006$), patients without hypertension (OR = 1.621, $P < 0.001$), patients with hypertension (OR = 1.621, $P < 0.001$), patients without diabetes mellitus (OR = 1.754, $P < 0.001$), patients with diabetes mellitus (OR = 3.270, $P = 0.002$), patients without coronary heart disease (OR = 1.856, $P < 0.001$), patients with coronary heart disease (OR = 1.793, $P = 0.009$), patients without cerebral infarction (OR = 1.746, $P < 0.001$), patients with cerebral infarction (OR = 6.158, $P = 0.002$), patients without chronic kidney disease (OR = 1.811, $P < 0.001$), patients without immune system disease (OR = 1.886, $P < 0.001$), patients without neoplastic disease (OR = 1.802, $P < 0.001$), patients with neoplastic disease (OR = 3.161, $P = 0.030$), patients without neurodegenerative disease (OR = 1.765, $P < 0.001$), patients without other comorbidities (OR = 2.329, $P < 0.001$), patients with other comorbidities (OR = 1.492, $P < 0.001$), patients without Paxlovid (OR = 2.176, $P < 0.001$), patients with Paxlovid (OR = 1.739, $P < 0.001$), patients with Lianhua Qingwen granules (OR = 1.834, $P < 0.001$), and patients without Lianhua Qingwen granules (OR = 1.835, $P < 0.001$).

In addition, in the stratified analysis with chronic kidney disease (OR = 1.621, $P = 0.067$) and neurodegenerative disease (OR = 4.068, $P = 0.075$), although it did not achieve statistical significance, the OR of D-dimer was still greater than 1.0. In cases with immune system diseases (OR = 0.847, $P = 0.753$), the OR of D-dimer was less than 1.0, but there was no statistical significance.

DISCUSSION

5. Discussion

Previous studies have shown that pneumonia is often regarded as a terminal event that complicates long-term diseases, such as dementia, cardiovascular disease, and cancer, in the elderly[25]. SARS-CoV-2 mainly causes pulmonary interstitial pneumonia changes, typical bilateral patchy ground glass shadows, and peripheral consolidation. Compared with other age groups, the elderly seem to be more susceptible to COVID-19 infection, and severe infection is an important reason for the high mortality rate and intensive care unit hospitalization rate of elderly patients with COVID-19[26,27]. In previous reports, the case fatality rate of elderly patients with COVID-19 ranged from 8.0% to 37.5%, and the case fatality rate increased with age [26,28,29]. In addition, the population characteristics include a higher male proportion, intense inflammatory response in the body, prolonged viral shedding time, and prolonged hospital stay [26,30].

This study also found that elderly patients with severe COVID-19 were older and had a higher male proportion than non-severe COVID-19 patients. The inflammatory reaction in severe patients was more intense than that in non-severe patients. At the same time, the level of lactic acid and D-dimer in severe patients was significantly higher than that in non-severe patients, and the estimated glomerular filtration rate was lower than that in non-severe patients. The length of hospitalization and viral shedding time of severe patients were longer than those of non-severe patients. In this study, the severe infection group had lower vaccination rates than those without severe infection, however, the vaccination status was proven to be not significant in univariate and multivariate analysis of the development of severe infection in elderly patients with COVID-19 suggesting that vaccination status was associated with significantly lower risk of hospitalization for COVID-19 infection but not associated with the development of severe COVID-19 in elderly patients, which was similar to a previous observational study[31]. As for the management and treatment of COVID-19 in this study, no difference was observed in the application of Paxlovid in severe and non-severe

patients, suggesting that application of Paxlovid did not benefit patients in terms of avoiding the development of severe COVID-19 in this study. On the other hand, the need for respiratory support, glucocorticoids, anticoagulation (low molecular weight heparin or ordinary heparin), and antibiotic therapy was significantly higher in severe patients than in non-severe patients. This is consistent with current research showing that COVID-19, like other community-acquired pneumonia, is considered to be a late-stage event that complicates long-term disease[26]. To personalize the clinical management of COVID-19, researchers are also reflecting on better therapeutic strategies, including early adoption of NSAIDs[32], application of the broad-spectrum antimicrobials[33], and a personalized risk-benefit ratio for glucocorticoid use[34]. In terms of clinical outcome, 15 people died in this study, among which the mortality rate of non-severe patients was 0% and that of severe patients was 18.29%. The mortality rate of severe patients was significantly higher than that of non-severe patients, which was also consistent with previous literature reports[26,30].

In addition to the age factor, the presence and quantity of comorbidities are considered to be key factors in predicting the death of elderly patients. However, the significance of specific comorbidities, such as hypertension, coronary heart disease, and respiratory diseases, in the development of severe COVID-19 in elderly patients varied in previous research results[35-38]. The results of this study also showed that the proportion of chronic respiratory diseases, cerebral infarction, chronic renal diseases, and neurodegenerative diseases was higher in severe patients than in non-severe patients. Further analysis of the predictive factors of severe disease in elderly patients showed that among all the comorbidities, cerebral infarction was the only risk factor for the development of severe disease in elderly patients with COVID-19 in this study.

In addition, studies have found that elderly patients who come from long-term care centers seem to have a higher rate of severe illness and fatality on admission than elderly patients who come from families [26]. Indeed, staying in a long-term care center is a strong risk factor for COVID-19 diagnosis and all-cause mortality[39]. Studies have suggested that this may be related to the fact that elderly COVID-19 patients living in

long-term care centers usually suffer from more comorbidities, are physically weaker, and are more susceptible to infection when these patients stay in a closed environment[26]. In this study, cerebral infarction was a risk factor for severe COVID-19 in elderly patients. It can be explained that elderly people with cerebral infarction may need to stay in bed for a longer period and need increased daily nursing care. As a result, this group of people tends to miss the early identification of COVID-19 infection or receive insufficient nursing care after COVID-19 infection, leading to severe infection in these patients. Therefore, the results of this study showed that elderly COVID-19 patients with cerebral infarction may be the most vulnerable group of elderly COVID-19 patients during the current wave of COVID-19 Omicron infection in Shanghai.

In previous studies, plasma D-dimer levels were directly related to the development of pulmonary embolism and vascular thrombosis complications during COVID-19 and were highly correlated with adverse outcomes[40,41]. In this study, D-dimer is also a risk factor for the development of severe COVID-19 in elderly patients, which is consistent with previous literature reports[42]. In previous studies, NLR, CRP, and neutrophil percentage were demonstrated to be predictors of severe diseases, showing good recognition ability for severe COVID-19[17,37,43]. In this study, it was found that compared with white blood cell count, neutrophil percentage, CRP, PCT, NLR, SIRI, and lactic acid, the ROC curve of D-dimer yielded the largest AUC, with good sensitivity and specificity and an outstanding ability to identify severe COVID-19. In the multivariate stratified analysis, D-dimer was a risk factor for the development of severe COVID-19 in elderly patients both at the overall level and stratified by sex, age, vaccination, chronic respiratory disease, hypertension, diabetes mellitus, coronary heart disease, cerebral infarction, chronic kidney disease, immune system disease, neoplastic disease, neurodegenerative disease, other comorbidities, the use of Paxlovid, and the use of Lianhua Qingwen granules levels. This confirmed the important role of D-dimer in the course and outcome of COVID-19 in elderly patients.

This study has at least two limitations. First, the sample size of this study was small, especially the number of patients in the severe disease group. This may be related

to the relatively reduced pathogenicity of the Omicron subtype in the current wave of COVID-19 infection and the protective effect of the vaccine in reducing risk of hospitalization for COVID-19 infection, which is a result of active participation in receiving the vaccine in Shanghai. Second, this study was a single-center study, and the patients were limited to those diagnosed with COVID-19 and admitted to the Ninth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine from April 2022 to June 2022. Because the outbreak is evolving rapidly around the world, follow-up studies are needed to enroll more patients to improve the statistical power of these findings.

CONCLUSION

In conclusion, the results of this study suggested that COVID-19 infection complicates long-term illness in elderly patients. There are considerable differences in disease severity and adverse clinical outcomes between severe and non-severe cases in older patients with COVID-19. Elderly people are vulnerable to severe illness and death due to their age and comorbidities, especially elderly patients with pre-existing cerebral infarction. D-dimer is a risk factor for severe disease in elderly patients and has a good recognition function for severe disease. Therefore, a comprehensive assessment of the comorbidities of older patients with COVID-19 may help to establish risk stratification for admission of COVID-19 patients, and dynamic monitoring of D-dimer levels can provide valuable information for planning appropriate interventions at the health assistance level.

ARTICLE HIGHLIGHTS

Research background

Elderly patients are at higher risk of contracting and dying from Coronavirus disease 2019 (COVID-19) due to advanced age, decreased immune function, intense inflammatory response, and comorbidities. Omicron, a new variant of severe acute

respiratory syndrome coronavirus 2, have a high transmission rate and significant antibody avoidance, posing a great threat to the prevention and control of COVID-19.

Research motivation

Previous studies have evaluated the risk factors of severity or death among elderly people with COVID-19, the analyses of Omicron infection risk and protective factors among elderly people were relatively few. There is a pressing need to identify the clinical features and risk factors in disease progression among elderly patients with Omicron infection to provide solid evidence for clinical policymakers, public health officials, researchers, and the general public.

Research objectives

To identify the clinical features and risk factors in disease progression among elderly patients with Omicron infection to provide solid evidence for clinical policymakers, public health officials, researchers, and the general public.

Research methods

A Chi-square test, *t* test, Mann–Whitney U test, hierarchical log-rank test, univariate and multivariate logistic regression, and hierarchical analyses were used to determine statistical differences between elderly patients with severe and non-severe Omicron SARS-CoV-2 variant infection.

Research results

The clinical course of severe patients is more complex, as both the need for symptomatic treatment and the risk of death are higher than that of non-severe patients. Oxygen saturation, cerebral infarction, and D-dimer are risky factors for developing severe COVID-19 infection. D-dimer also showed a suitable role in identifying severe infection.

Research conclusions

Elderly people are vulnerable to severe illness and death due to their age and comorbidities, especially elderly patients with pre-existing cerebral infarction. D-dimer is a risk factor for severe disease in elderly patients and has a good recognition function for severe disease.

Research perspectives

A comprehensive assessment of the comorbidities of older patients with COVID-19 may help to establish risk stratification for admission of COVID-19 patients, and dynamic monitoring of D-dimer levels can provide valuable information for planning appropriate interventions at the health assistance level.

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