Original Article

Therapeutic effects of multidisciplinary individualized treatment for COVID-19 patients: the experience of a supporting medical team in Wuhan

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Background: The sudden outbreak of coronavirus disease 2019 (COVID-19) has brought people around the world into an abyss of suffering. At that time, there were no clear and effective means for the treatment of the virus. We prepared a medical team consisted of specialists in critical care, respiratory diseases, infections, gastroenterology, endocrinology, cardiology, cerebrovascular diseases, nephrology, rehabilitation, psychology, and nutrition. This study shared our multidisciplinary treatment experience in treating patients with COVID-19.

Methods: Patients with positive SARS-CoV-2 swab test were divided into three groups: ordinary cases, severe cases and critical cases. Every patient received the multi-disciplinary comprehensive and individualized tailored treatment based on the specific situation of each patient. Patients' medical records, epidemiological, clinical, laboratory, radiological characteristics, Borg dyspnea score, Barthel index, self-rating anxiety scale (SAS) as well as treatment and outcome data were analyzed.

Results: The mean age of the 90 patients was 61.88±15.25 years. Some patients without underlying disease had developed comorbidities such as hyperglycemia (24, 26.67%) and hypertension (9, 10%). With multidisciplinary individualized treatment, the patients' albumin level and Barthel index score increased significantly, while glucose level, blood pressure, and Nutrition Risk Screening 2002 (NRS-2002), Borg scale, and SAS values significantly decreased at discharge. The in-hospital mortality rate was 4.44%. However, there was still a gap in Nutrition Risk Screening, Borg dyspnea score and Barthel index between the critical cases and the ordinary and severe cases at discharge. We observed that the patients with more severe disease had significantly higher age, rates of hypertension, and mortality. The median hospitalization time of discharged patients was 19 days [interquartile range (IQR), 9.0–20.0 days].

Conclusions: Multidisciplinary collaboration and individualized treatment could effectively improve the

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general status of patients with different severity of COVID-19.

Keywords: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); coronavirus disease 2019 (COVID-19); severely ill patient; multidisciplinary treatment

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Introduction

The outbreak of 2020 put the world in a state of panic, and it continues to affect the lives of people worldwide (1). Weeks after the outbreak, sequencing analysis identified a novel betacoronavirus, the 2019 novel coronavirus (2019-nCoV), as the causative agent of the observed pneumonia cluster (2). On February 11, 2020, the World Health Organization (WHO) named the illness coronavirus disease 2019 (COVID-19) (3). Based on phylogenetic analysis, the Coronavirus Study Group suggested designating 2019-nCoV as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (4). The COVID-19 epidemic rapidly spread around the world due to high transmissibility of the virus, with an ongoing daily reporting of new cases and deaths (5,6). According to the WHO Coronavirus Disease 2019 Situation Report of 11 October 2020, there were more than 37.1 million cumulative cases and 1.07 million cumulative deaths (7).

At that time, there was a dearth of comprehensive global understanding regarding COVID-19, the therapeutic efficacy of glucocorticoids (GCs) (8) and convalescent plasma (9) in the treatment of adult patients with COVID-19 was still under trial. There were no effective treatment for 2019 novel coronavirus has been found in the short term (10). The surge of patients within a short period and relatively scarce health-care resources were risk factors for the high fatality rate of COVID-19 (11,12). For those areas experiencing a COVID-19 outbreak, the government could relieve the pressure on the local medical system by mobilizing external resources. In the absence of an effective treatment strategy, how the allocation of these medical resources can be optimized is worthy of further exploration.

On February 9, 2020, the Chinese government requested a second batch of medical teams to support Wuhan in fighting COVID-19, consisting mainly of intensive care specialists. Our center organized a multidisciplinary medical team of specialists in the fields of intensive care, respiratory diseases, infections, cardiology, endocrinology, rehabilitation, nutrition, psychology, and nursing. We went to Wuhan to assume control of the Guanggu Branch of Tongji Hospital, Huazhong University of Science and Technology, and we were mainly responsible for the management of critically ill COVID-19 patients. The purpose of this study was to report our experience in fighting COVID-19 and evaluate the effectiveness of a multidisciplinary individualized approach to treating COVID-19. We present the following article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1428/rc).

Methods

Patients

This was a retrospective cohort study. A medical team from the Third Affiliated Hospital of Sun Yat-sen University was sent to Guanggu Branch of Tongji Hospital, Huazhong University of Science and Technology to support the fight against COVID-19. The subjects of our study were patients with COVID-19 admitted to our medical team at the Guanggu Branch of Tongji Hospital, Huazhong University of Science and Technology between February 9, 2020 and March 29, 2020. Inclusion criteria: patients with positive SARS-CoV-2 swab test. Exclusion criteria: patients who met the clinical definition of death within 24 hours of admission. Discharge criteria: patients with at least two consecutive negative SARS-CoV-2 swab tests. According to the guidelines (13), patients were divided into three groups: ordinary cases, severe cases and critical cases. All patients who participated in this study signed an informed consent form, and this study was approved by the Medical Ethics Committee of the Third Affiliated Hospital of Sun Yat-sen University (No. [2020]02-090-01). Tongji Hospital, Huazhong University of Science and Technology was informed and agreed with this study. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

Table 1 Patients' clinical characteristics by severity

Parameters	Moderate (n=13)	Severe (n=63)	Critical (n=14)	All (n=90)	P
Age (years)	50.46±14.68	63.19±14.21	66.57±16.34	61.88±15.25	0.017
Sex					0.453
Male	7 (53.85)	26 (41.27)	8 (57.14)	41 (45.56)	
Female	6 (46.15)	37 (58.73)	6 (42.86)	49 (54.44)	
Hypertension					0.040
No	10 (76.92)	35 (55.56)	4 (28.57)	49 (54.44)	
Yes	3 (23.08)	28 (44.44)	10 (71.43)	41 (45.56)	
Diabetes					0.589
No	12 (92.31)	54 (85.71)	11 (78.57)	77 (85.56)	
Yes	1 (7.69)	9 (14.29)	3 (21.43)	13 (14.44)	
Dead					0.016
No	13 (100.00)	62 (98.41)	11 (78.57)	86 (95.56)	
Yes	0 (0.00)	1 (1.59)	3 (21.43)	4 (4.44)	

Data are presented as mean ± standard deviation or n (%).

Data collection and definitions

At admission and discharge every patient' medical records were analyzed by our medical team. Epidemiological, clinical, laboratory, radiological characteristics, Borg dyspnea score, Barthel index, self-rating anxiety scale (SAS) as well as treatment and outcome data were obtained via data collection forms, which were reviewed by an appropriately trained physician team.

Hyperglycemia was defined as fasting plasma glucose >126 mg/dL (7.0 mmol/L). Hypertension was defined as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg without the use of hypotensive agents on 3 measures on different days.

Therapeutic schedule

Our team made a multi-disciplinary comprehensive diagnosis and treatment for patients, the focus was on indicators and clinical manifestations of crisis life. Every patient had an individual treatment plan, including nutrition, rehabilitation, psychological intervention, antiviral, anti-infection, immune modulation, etc. At the same time, the nursing work also achieves "one plan for each patient".

Statistical analysis

Continuous data are expressed as mean ± standard deviation (SD), while categorical data are expressed as number and percentage (%). For comparisons of means between paired groups (admission and discharge), Student's paired *t*-test was used. For comparisons among severity groups (moderate, severe, and critical), one-way analysis of variance (ANOVA) was used. If normality was not assumed, Wilcoxon signed-rank test and Kruskal-Wallis test were used instead. Chi-square test was used to evaluate the difference in distribution of categorical data between two groups, and if any expected value lower than 5 was observed, Fisher's exact test was used instead. For each test, P<0.05 (two-tailed) was recognized as reaching significance. All analyses were performed using SPSS version 25 (IBM Corp., Armonk, NY, USA).

Results

Patients' clinical characteristics

A total of 90 COVID-19 patients (41 males and 49 females, mean age =61.88±15.25 years) were included in this study. With respect to disease severity, there were 13 moderate cases, 63 severe cases, and 14 critical cases.

There were 41 (45.56%) and 13 (14.44%) patients with hypertension and diabetes, respectively. All patient results were recorded at admission and discharge. Patients with more severe disease were observed to have significantly higher age, rates of hypertension, and mortality (all P<0.05, *Table 1*).

Table 2 The outcome index of all patients at admission (pre) and discharge (post)

Parameters	Admission	Discharge	P
Albumin (g/L)	36.08±4.49	38.86±3.65	0.001
Leukocyte (10^9/L)	6.54±3.53	6.11±2.32	0.367
SBP (mmHg)	134.07±20.58	131.31±10.55	0.041
DBP (mmHg)	84.20±13.25	77.15±7.20	<0.001
Glucose (mmol/L)	6.37±2.65	5.58±1.43	0.001
NRS-2002	3.88±1.11	2.88±1.11	<0.001
Borg	3.53±2.33	1.28±1.95	<0.001
Barthel index	92.47±20.88	94.76±17.68	0.003
SAS	46.37±6.38	40.85±34.06	<0.001

Data are presented as mean ± standard deviation. The paired *t*-test included only the patients for whom there was no missing data at both admission and discharge; therefore, the means are slightly different from those in *Table 3* which were calculated based on all available patients. SBP, systolic blood pressure; DBP, diastolic blood pressure; NRS-2002, Nutrition Risk Screening 2002; SAS, self-rating anxiety scale.

Some patients without underlying disease had developed comorbidities such as hyperglycemia (24, 26.67%) and hypertension (9, 10%).

Comparison of outcome indexes between admission and discharge

The results of all patients were compared between admission and discharge. As shown in *Table 2*, patients' albumin and Barthel index scores significantly increased, while SBP, DBP, glucose, Nutrition Risk Screening 2002 (NRS-2002) scores, Borg scale values, and SAS scores significantly decreased at discharge compared with those at admission (all P<0.05).

Outcome indexes among severity groups

The outcome indexes among different severity groups were compared (*Table 3*). For albumin, glucose, and SAS score, the index differed among groups at admission (both P<0.05), and then became insignificant at discharge (both P>0.05).

Leukocytes decreased at discharge in both the severe and critical groups but were significantly different between groups at discharge (P=0.049).

For NRS-2002, Borg, and Barthel scores, significant differences among groups were observed at both admission and discharge (all P<0.001). The changing trends of all indexes of the three groups are shown in *Figure 1*.

Treatment outcome

Of the 90 patients, 95.56% of cases recovered and discharged. Only four patients died during hospitalization, including one severe and three critical cases. The median hospitalization time of discharged patients was 19 days [interquartile range (IQR), 9.0–20.0 days].

Discussion

COVID-19 became a global health threat due to its high transmissibility, high proportion of critical patients, and high mortality (14-16). Elderly COVID-19 patients with chronic disease had a poor prognosis and were most likely to develop into critically ill patients (13), and the COVID-19 pandemic had resulted in significant mental health problems among affected residents (17). In this study, the mean age of critical patients was 66.57±16.34, which was significantly higher than that of the moderate patients and severe patients. This result is in line with previous studies reporting that a considerable proportion of the critically ill COVID-19 patients are elderly (18,19). Studies have shown that severe COVID-19 can cause hyperglycemia in patients without a history of diabetes (20,21). This study also found that some critical COVID-19 patients without underlying disease had hyperglycemia and hypertension symptoms at admission. After further investigation, we found that many elderly patients had poor self-care ability, and they usually needed the assistance of their family members in their daily lives. However, during the epidemic, their relatives were quarantined or had died. Lack of care, poor quality of life, irregular diet, and autonomic dysfunction after COVID-19 infection (22) may have led to symptoms of hyperglycemia and hypertension in these patients, increasing the difficulty of recovery and causing high mortality in critical COVID-19 patients (23). In addition, there were no specific drugs or treatment options available for patients with severe COVID-19 at that time.

It is difficult for a single specialized faculty to meet all the medical needs of patients from different sources. Our multidisciplinary medical team primarily consisted of specialists in critical care, respiratory diseases, and infections, assisted by specialists in gastroenterology, endocrinology, cardiology, cerebrovascular diseases,

Table 3 The outcome index by severity group

Parameters	Moderate (n=13)	Severe (n=63)	Critical (n=14)	All (n=90)	P
Albumin (g/L)					
Admission	40.85±4.73	37.41±4.71	34.61±4.42	37.37±4.87	0.025
Discharge	–	39.27±3.30	36.92±4.71	38.86±3.65	0.200
Leukocyte (10^9/L)					
Admission	5.58±1.21	6.20±2.90	8.69±5.49	6.49±3.36	0.321
Discharge	–	5.71±1.56	8.04±4.01	6.11±2.32	0.049
SBP (mmHg)					
Admission	129.23±20.57	135.98±20.74	127.00±21.58	133.69±20.92	0.275
Discharge	129.92±9.27	132.08±10.86	128.00±10.40	131.31±10.55	0.357
DBP (mmHg)					
Admission	79.54±12.16	86.03±12.49	79.15±17.11	84.08±13.39	0.062
Discharge	74.00±7.20	77.71±7.15	77.89±7.13	77.15±7.20	0.200
Glucose (mmol/L)					
Admission	5.02±0.51	6.60±2.99	7.34±2.83	6.47±2.80	<0.001
Discharge	5.20±0.38	5.41±1.02	7.00±2.91	5.58±1.43	0.121
NRS-2002					
Admission	3.00±0.00	3.97±1.06	5.54±1.76	4.06±1.31	<0.001
Discharge	2.00±0.00	2.92±1.00	3.89±1.69	2.88±1.11	<0.001
Borg					
Admission	1.38±0.51	3.37±1.73	7.69±2.14	3.71±2.45	<0.001
Discharge	0.08±0.28	0.91±0.80	5.10±3.45	1.28±1.95	<0.001
Barthel					
Admission	100.00±0.00	96.11±11.23	53.46±36.93	90.45±22.66	<0.001
Discharge	100.00±0.00	98.06±7.09	67.50±40.43	94.76±17.68	<0.001
SAS					
Admission	45.15±5.65	46.30±6.55	53.63±7.96	46.83±6.87	0.025
Discharge	36.46±1.61	42.05±38.80	37.00±5.18	40.75±33.86	0.540

Data are presented as mean ± standard deviation. SBP, systolic blood pressure; DBP, diastolic blood pressure; NRS-2002, Nutrition Risk Screening 2002; SAS, self-rating anxiety scale.

nephrology, rehabilitation, psychology, and nutrition, to tackle complicated patient conditions. Combining the strengths of each specialty, the team discussed patients' conditions daily. Based on managing the pulmonary infection, the patients were provided with psychological counseling as appropriate for the specific setting in response to the issues identified. With comprehensive analysis and individualized treatment, each patient received appropriate targeted treatment, especially for extrapulmonary diseases. The psychological anxieties of the patients were alleviated, and their blood pressure and blood glucose levels were controlled. Among them, three patients failed to have their blood glucose improved, and all three patients died. However, the patients at high nutritional risk at admission eventually recovered and were discharged. This is one of the reasons for the high cure rate of our COVID-19 patients.

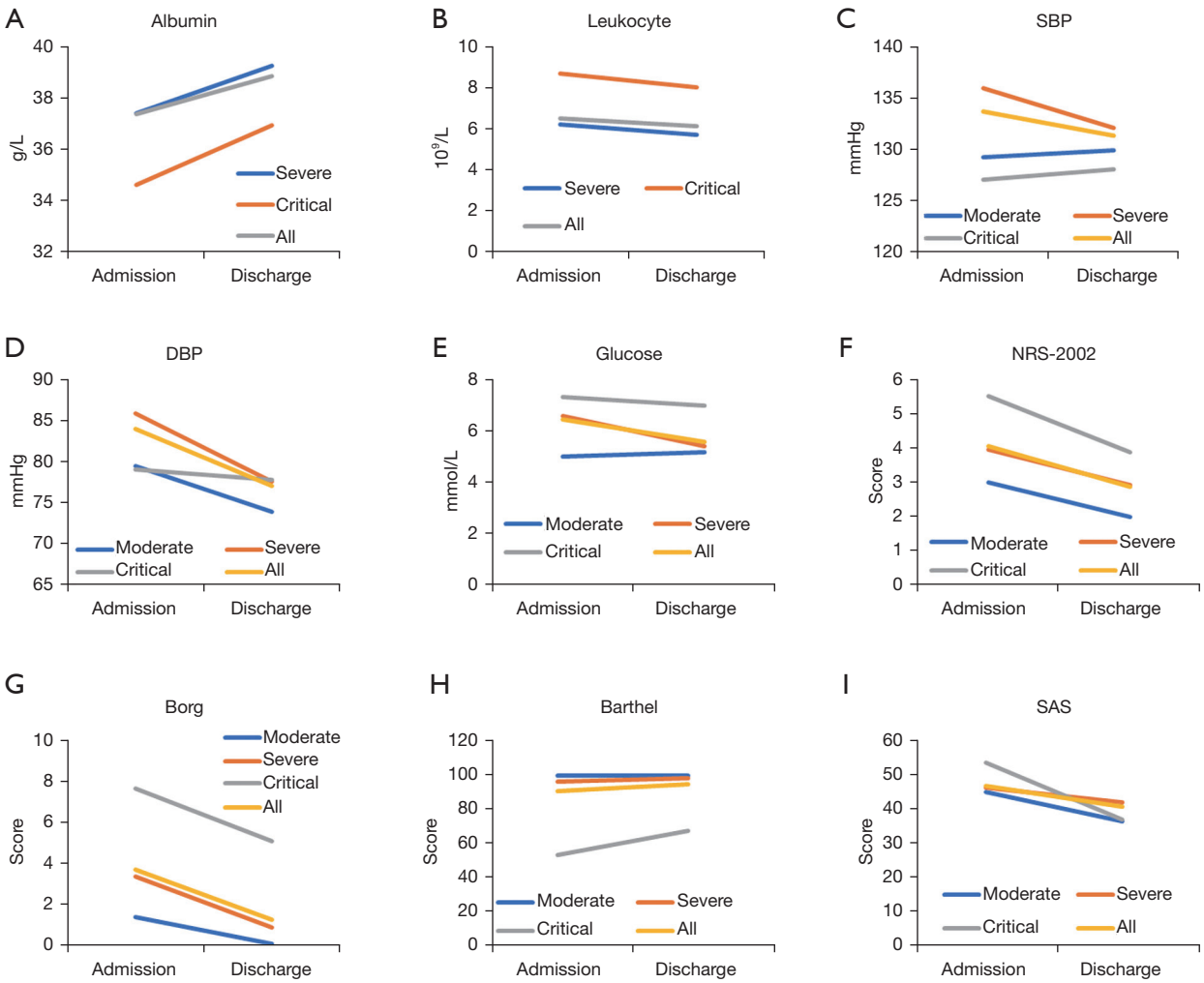

Figure 1 The outcome indexes over time by severity group, including albumin (A), leukocyte (B), SBP (C), DBP (D), glucose (E), NRS-2002 (F), Borg (G), Barthel (H), and SAS (I). SBP, systolic blood pressure; DBP, diastolic blood pressure; NRS-2002, Nutrition Risk Screening 2002; SAS, self-rating anxiety scale.

Patients' poor self-care ability and poor quality of life during the epidemic led to further aggravation of the disease condition (24). Existing studies have also confirmed that nutritional status (25) and self-care ability (26) are associated with poor prognosis in COVID-19 patients. In our study, we evaluated COVID-19 patients with multiple assessment methods, including combined nutrition assessment, self-care ability assessment, and Borg scale. As we found, elderly patients had poor self-care ability (at admission, mean NRS-2002 score >3 and Barthel index =92.47±20.88). It is difficult for patients with poor self-care ability to cooperate with medical plans, and conventional medical plans are not expected to help their prognosis. To resolve this problem, we strengthened medical and nursing teams to ensure that there were doctors and nurses in the isolation ward at all times to provide family-style care. For patients with poor self-care ability, nurses focused on daily living, rehabilitative training, and individualized diet and administered medications to facilitate the restoration of the patient's prepandemic pace and state of life. For patients with poor coordination, we communicated with family members to understand patients' habits and achieve psychological communication so that patients could be more cooperative during treatment. A large number of our medical team members went deep into the isolation ward to improve patients' quality of life and implement the

treatment plan rather than merely formulating it outside the isolation ward. Finally, the nutritional score and Barthel index were significantly improved. During the 50 days we spent providing assistance in Wuhan, our medical team (133 medical staff) consumed more than 4,000 sets of protective clothing, which was another important factor contributing to our high treatment effectiveness.

Conclusions

In summary, multidisciplinary collaboration and the use of individual treatment plans could effectively reduce the rate of missed diagnosis of basic diseases. We formulated optimal comprehensive individualized treatment plans for COVID-19 patients to avoid improper treatment or overtreatment. Our approach could also reduce the randomness of decisions made by clinicians based on empirical treatment, effectively improving the treatment effect for COVID-19 patients, particularly in reducing the hospital stay and mortality of complex and severe cases. Most critical patients achieved a satisfactory clinical outcome. Our experience could be used for reference by other medical institutions.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1428/rc

Data Sharing Statement: Available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1428/dss

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-1428/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work, including ensuring that any questions related to the accuracy or integrity of any part of the work have been appropriately investigated and resolved. All patients who participated in this study signed an informed consent form, and this study was approved by the Medical Ethics Committee of the Third Affiliated Hospital of Sun Yat-sen University (No. [2020]02-090-01). Tongji Hospital, Huazhong University of Science and Technology was informed and agreed with this study. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

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