Clinical characteristics of 57 patients infected with COVID-19 in Baodi area of Tianjin, China

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Abstract

Background

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has been spreading worldwide.

Objective

To study the clinical characteristics of COVID-19, we included 57 real-time RT-PCR confirmed patients in Baodi area of Tianjin, China, admitted to hospital from 31 January 2020 and 22 February 2020.

Methods

Epidemiological, demographic, clinical, and radiological features and laboratory data were analyzed. Patients were confirmed by real-time RT-PCR with pharyngeal swab and/or sputum samples. Some patients that presented positive results with sputum samples yielded negative results with multiple swab tests, suggesting sputum samples RT-PCR tests may be a more reliable means of positively diagnosing infected individuals.

Results

Of the 57 patients studied, three were mild and 54 were moderate in severity. None of the patients infected traveled to Wuhan indicating all studied cases were infected by human to human transmission. The most common symptoms at onset of illness were included fever (86%), cough (29.8%), myalgia or fatigue (14%), chest tightness (5.3%), sore throat (5.3%), and diarrhea (5.3%).

Conclusion

Compared with patients of COVID-19 in Wuhan, the symptoms of patients in Baodi area of Tianjin province are relatively mild.

Introduction

In December of 2019, a series of cases of severe pneumonia were identified in Wuhan, Hubei Province, China [1, 2]. These infections were eventually found to be cases of COVID-19 (coronavirus disease 2019), which was caused by a previously uncharacterized beta coronavirus that was designated 2019-nCoV or SARS-CoV2 [3]. Symptoms of COVID-19 disease include a dry cough, fever, shortness of breath, fatigue, and lymphopenia [4]. Sequencing of the 2019-nCoV genome revealed it to be a beta coronavirus from a clade that was distinct from related members of the Orthocoronavirinae sub-family of the Coronaviridae family responsible for prior outbreaks of severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) [5-7]. The 2019-nCoV virus has been shown to have a high affinity for

receptors expressed on human respiratory cells and can cause severe morbidity and mortality, making it a serious ongoing global public health threat.

While the number of infected COVID-19 patients continues to rise, at present there have been only a limited number of studies published regarding clinical investigations of affected patients [8]. Prior studies have offered some insight into the clinical characteristics of this disease, as well as associated epidemiological, laboratory, and radiological findings, and treatment strategies and associated patient outcomes. Given the constantly evolving nature of this ongoing pandemic, additional studies regarding the clinical and epidemiological characteristics of pneumonia caused by 2019-nCoV are needed. In the present study, we therefore conducted a comprehensive epidemiological and clinical examination of 57 confirmed cases of 2019-nCoV pneumonia among patients admitted to Baodi Hospital in Tianjin.

Methods

Data collection

This was a retrospective study of 57 patients with confirmed cases of COVID-19 diagnosed between 31 January 2020 and 22 February 2020 in the Baodi area of Tianjin, China. In this region, specific clinics were designated to receive patients with a fever or any respiratory symptoms consistent with COVID-19 infection such as a dry cough. These clinics were additionally intended to receive any patients with a history of travel to Wuhan or the local department store (Baodi department store) where infections had been detected within two weeks prior to symptom onset. The case definitions of confirmed infections caused by the 2019-nCoV virus were based on the interim guidance of the World Health Organization (WHO) [9], and only individuals with laboratory-confirmed cases were included in the present study (n = 57). The data pertaining to these patients was collected from seven designated tertiary hospitals in the Baodi area of Tianjin. We collected data pertaining to the date of symptom onset, visits to clinical facilities, and hospital admissions. All epidemiological data had been gathered through interviews with infected patients by multiple investigators, in an effort to produce a comprehensive exposure history for each patient over the two weeks prior to symptom onset. These interviews sought to determine any times when patients were likely to have been exposed to individuals that had visited a known epicenter of this outbreak, such as Wuhan or Baodi department store.

Medical records of patients with confirmed COVID-19 disease were extracted and sent to a data collection center in Baodi for review and interpretation by doctors that had been treating COVID-19 patients. The requirement for informed consent was waived for this study due to the serious nature of this emerging pandemic and the urgent need to produce comprehensive clinical and epidemiological datasets pertaining thereto. Clinical data were collected using a standardized care form. In cases where information was unclear, the doctors responsible for the care of the patient(s) in question were contacted for clarification.

Laboratory confirmation and treatment

Upon admission, throat swab and sputum samples were collected from all patients and were tested by real-time polymerase chain reaction (RT-PCR) in order to confirm the presence of 2019-nCoV viral RNA [1]. This detection was conducted twice with >24 h between tests in order to ensure the accuracy of the resultant diagnosis.

Upon admission, all patients were subjected to a battery of laboratory tests including routine serum biochemistry, a complete blood count, and testing for the presence of other viral respiratory pathogens such as influenza A virus (H1N1, H3N2, H7N9), influenza B virus, respiratory syncytial virus, parainfluenza virus, and adenovirus. The majority of patients were administered Ribavirin (50 mg, twice per day). In addition, some patients were treated with corticosteroids (40-80 mg/day for 3-5 days) when their resting respiratory rate was greater than 30 breaths per minute, when their blood oxygen saturation was < 93% without oxygen, or when more than one pulmonary lobe exhibited > 50% disease progression upon imaging within a 48 h period. Patients also received treatment with traditional Chinese medicine and antibiotics in most cases. When patients exhibited a fever that persisted for longer than 7 days or had C-reactive protein levels > 30 mg/L (reference range: 0 - 10 mg/L), they were administered quinolones and second-generation beta-lactams (oral and intravenous).

Statistical analysis

Continuous variables are given as medians with interquartile ranges (IQRs), whereas categorical variables are given as frequencies with percentages [10]. Categorical data were compared via Fisher's exact test or a chi-squared test, as appropriate, while continuous data were compared via t-tests and the Mann-Whitney U test, as appropriate. $P < 0.05$ was the significance threshold.

Patient and public involvement

This study was a retrospective case series, and at no point in time were patients directly involved in designing the study, providing data, or influencing the interpretation of the data or the resultant manuscript.

Results

Epidemiological characteristics

As of the 22nd of February, 2020, 57 patients in the Baodi area had been confirmed to be infected by the 2019-nCoV virus. Of these 57 cases, three were considered mild and 54 were considered moderate in severity. As shown in Table 1, a total of 6 patients (10.5%) were < 30 years old, while 25 (43.9%) were 30-49 year old, 23 (40.3%) were 50-69 years old, and 3 (5.3%) were > 70 years old (median: 49 years, IQR: 37-64). In total, 34 patients (59.6%) were female. None of these patients had any known connection to the Wuhan where the initial spread of the 2019-nCoV virus was observed, suggesting that these were all cases of community-acquired disease. We found that 50 (87.7%) patient were associated with Tianjin

Baodi department store. They were department store employees or had visited the department store, or had known interactions with above patients infected with 2019-nCoV.

Table 1 Demographics and baseline characteristics of 57 patients with COVID-19 in Baodi area of Tianjin province, China [#]

	Diseases severity			<i>P</i> value
	All (N=57)	mild (n=3)	moderate (n=54)	
Age (median (IQR))	49 (37-64)	31 (30.5-54)	49 (37.3-64.8)	0.828
Age-groups (n (%))				
<30 y	6 (10.5)	0	6 (11.1)	0.119
30-49 y	25 (43.9)	2 (66.7)	23 (42.6)	
50-69 y	23 (40.3)	0	23 (42.6)	
≥70 y	3 (5.3)	1 (33.3)	2 (3.7)	
Sex (n (%))				
Female	34 (59.6)	1 (33.3)	33 (61.1)	0.34
Male	23 (40.4)	2 (66.7)	21 (38.9)	
Exposure history (n (%))				
Department store related	50 (84.7)	3 (100)	47 (82.4)	0.289
Signs and symptoms (n (%))				
Fever	49 (86.0)	3 (100)	46 (85.2)	0.63
Cough	19 (29.8)	0	19 (31.5)	0.338
Myalgia or fatigue	8 (14.0)	0	8 (14.8)	0.646
Chest tightness	3 (5.3)	0	3 (5.6)	0.848
Sore throat	3 (5.3)	0	3 (5.6)	0.848
Nasal congestion	1 (1.8)	0	1 (1.9)	0.947
Nausea and vomiting	2 (3.5)	1 (33.3)	1 (1.9)	0.103
Diarrhea	3 (5.3)	0	3 (5.6)	0.848

[#] COVID-19, coronavirus disease 2019; IQR, interquartile range; *P* values denoted the comparison between mild and moderate subgroups

The primary symptoms experienced by these patients included fever (49, 86%), cough (19, 29.8%), myalgia or fatigue (8, 14%), chest tightness (3, 5.3%), sore throat (3, 5.3%), and diarrhea (3, 5.3%). Nasal congestion was a symptom in only 2 patients (3.5%), while just 1 patient (1.8%) reported nausea.

Clinical features

Normal leukocyte counts ($3.5\text{--}9.5 \times 10^9/\text{L}$) were detected in the majority (49/56; 89.3%) of patients, whereas these counts were elevated or decreased in 2 (3.6%) and 5 (7.1%) patients, respectively. As shown in Table 2, lymphopenia ($<1.1 \times 10^9$ lymphocytes/L) was detected in 22/55 patients (40%), while 17/53 patients (32.1%) exhibited reduced neutrophil frequencies and 26/53 patients (45.6%) exhibited elevated C-reactive protein levels. A total of 54 (94.7%) patients presented abnormalities on chest

computed tomograms or radiographs (CT) and 3 (5.3%) patients were normal. Of these patients, 41 (71.9%) exhibited bilateral involvement, whereas 13 (22.8%) exhibited unilateral involvement in chest radiographs (Table 2). At the time of admission, chest CT findings in infected patients were unilateral or bilateral lobular or sub-segmental areas of consolidation or bilateral ground-glass opacity (Figure 1).

Table 2 Laboratory, chest radiological characteristics and treatments of 57 patients with COVID-19 in Baodi area of Tianjin province province, China

	All (n=57)	Diseases severity		<i>P</i> value
		mild (n=3)	moderate (n=54)	
Laboratory parameters				
Leukocytes (×10 ⁹ /L, normal range 3.5-9.5)	4.9 (4.2-6.8)	7 (5.8-7.05)	4.8 (4.2-6.7)	0.517
Increased (n/N (%))	2/56 (3.6)	0	2/53 (3.8)	0.895
Decreased (n/N (%))	5/56 (7.1)	0	5/53 (9.4)	0.797
Lymphocytes (×10 ⁹ /L, normal range 1.1-3.2)	1.3 (0.9-1.7)	1.4 (1.4-2.1)	1.3 (0.9-1.7)	0.272
Decreased (n/N (%))	24/55 (40)	0	24/52 (46.1)	0.208
Lymphocyte percentage (% , normal range 20-50)	24.9 (19.2-31.9)	30.4 (24.5-34.7)	24.5 (19.2-31.8)	0.878
Decreased (n/N (%))	17/53 (32.1)	0	17/50 (34)	0.305
Neutrophil percentage (% , normal range 40-70)	65.3 (55.5-72.5)	54.3 (53-60.1)	65.3 (55.8-72.6)	0.348
Increased (n/N (%))	17/52 (32.7)	0	17/49 (34.7)	0.296
CRP (mg/L, normal range <10mg/L)	9.95 (5.3-23)	3.6 (2.1-6.7)	12.6 (5.4-24.5)	0.402
Increased (n/N (%))	26/53 (45.6)	2/3 (66.7)	43/50 (86)	0.394
Chest CT images (n/N (%))				
Normal	3/57 (5.3)	3/3 (100)	0	<0.001
Unilateral abnormal	13/57 (22.8)	1/3 (33.3)	13/54 (24.1)	0.704
Bilateral abnormal	41/57 (71.9)	2/3 (66.7)	41/54 (75.9)	0.615
Ground-glass opacities (GGO)	35/57 (61.4)	0	35/54 (64.8)	0.233
Consolidation	6/57 (10.5)	0	6/54 (11.2)	0.737
Mixed GGO and consolidation	13/57 (22.8)	0	13/54 (24)	0.535
Number of times of RT-PCR test to present positive result (n/N (%))				
Pharyngeal swab				
First time	32/57 (56.1)	2/3 (66.7)	30/54 (55.6)	0.316
Second time	16/57 (28.1)	1/3 (33.3)	15/54 (27.8)	
Multiple time	9/57 (15.8)	0	9/54 (16.7)	
Sputum				
First time	6/6 (100)	0	6/6 (100)	NA
Treatment (n/N (%))				
Antiviral treatment	35/57 (26.3)	0	15/54 (27.8)	0.392
Traditional Chinese medicines	54/57	3/3 (100)	51/54 (94.4)	0.121

	(94.7)			
Antibiotics therapy	9/57 (15.6)	0	9/54 (16.7)	0.591
Use of corticosteroid	1/57 (1.8)	0	1/54 (18.5)	0.947

Data are (median (IQR)) or (n/N (%)); COVID-19, coronavirus disease 2019; CRP, C-reactive protein; IQR, interquartile range; *P* values denoted the comparison between mild and moderate subgroups; NA, not available

Of the patients included in this study, 32 (56.1%) presented with a single positive RT-PCR test result based upon pharyngeal swab samples, while 16 (28.1%) were positive in two tests. Nine (15.8%) patients were failed positive with 2 swab sample tests. Among these, three patients presented positive on further tests (> 3) with swab samples and 6 were confirmed positive with single sputum samples tests. A total of 35 of these patients (61.4%) received antiviral therapy, while 54 (94.7%) were treated with traditional Chinese medicine therapies, 9 (15.6%) received empirical antibiotic treatment, and 1 patient (1.8%) was administered corticosteroids.

Discussion

As of the 10th of March, 2020, there had been over 80,000 laboratory-confirmed cases of 2019-nCoV infections in China, and this number is growing rapidly from Centers for Disease Control and Prevention of China (www.chinacdc.cn). The true number of infected patients may be even higher, either because some patients suffer from very mild disease or because the virus can have a relatively long incubation period [11,12]. As is evident from our study and other similar reports, the clinical features of early COVID-19 cases in Wuhan were distinct from cases observed in other areas of China. In this study, 87.7% of patients were associated with a cluster of cases originating from a Baodi department store in Tianjin. None of these 57 patients reported any connection to the Huanan seafood market where the 2019-nCoV outbreak was first detected. Given that there were multiple familial clusters amid our patient cohort, our results further support the sustained human-to-human transmission of this virus.

The majority of patients in the present study from the Baodi area were female, which was consistent with prior reports in other cohorts (50.7% - 73.0%) [1,4]. Patients infected with 2019-nCoV in this study ranged from 9-77 years of age [1,4,13]. We did not observe any major differences between the initial clinical symptoms of these patients relative to patients in Wuhan. However, the majority of the patients in the present study suffered from only mild-to-moderate COVID-19 disease. The majority of patients reported fever (86.0%), cough (29.8%), and fatigue or muscle aches (14.0%) as their primary symptoms. However, it is important to monitor for patients with atypical symptoms such as nausea, vomiting, diarrhea, headache, dizziness, nasal obstruction, or pharyngeal discomfort. Laboratory tests from these patients indicated that leukocyte counts were generally normal (89.3%) or decreased (7.1%), while lymphopenia was commonly observed (40%). C-reactive protein levels were normal in only a subset of patients (45.6%), whereas procalcitonin was normal in all patients (100%), consistent with the characteristics of a viral

infection. The clinical and laboratory findings reported in this study are consistent with similar studies of other COVID-19 patient cohorts conducted to date [14,15].

Lung lesions were observed in 94.7% of the COVID-19 patients in the present study upon chest CT examination. The majority of these patients exhibited bilateral ground-glass opacity. Given the prevalence of this symptom, this suggests the conducting lung CT examinations can allow clinicians to effectively gauge disease progression and severity in affected patients. A combination of lung CT and clinical/laboratory testing may also be used to screen for infected patients. RT-PCR was used to confirm 2019-nCoV infection in all patients in the present study, and other pathogens were generally not detected in these patients. Pharyngeal swabs tested positive for 2019-nCoV nucleic acid in 32 patients (56.1%) on the first test, while the first tests were negative and the second tests were positive in 16 patients (28.1%). Sputum samples were tested from patients in which multiple pharyngeal swabs had yielded negative results, and 6 patients who were negative with multiple swab tests were positive on the first time sputum test. This indicates that sputum samples may be a more reliable means of positively diagnosing infected individuals [16,17].

As the majority of observed infections in the Baodi area were in patients that had no known contact with the original areas of Wuhan where this outbreak was first detected, these findings offer valuable information of the clinical and epidemiological features associated with COVID-19 disease [1]. The clinical symptoms of patients in the present study may be representative of those in patients infected with the 2019-nCoV virus in recent months. In an effort to further contain this virus and to curtail its further spread, additional quarantine protocols should be enacted and maintained. Measures that may be efficacious include banning any gatherings of >100 people and providing people accurate and up-to-date information regarding the pandemic [18].

Conclusion

Relative to the symptoms that had been detected in early patients infected by the 2019-nCoV virus in Wuhan, China, we found that infected patients in the Baodi area exhibited relatively mild symptoms. At present, there is no known efficacious treatment or vaccine that can protect against the 2019-nCoV virus. It is therefore vital that vigilant efforts to monitor for this pathogen be maintained and strengthened, quarantine protocols should be implemented and that resource be directed to ensure that effective prophylactic and therapeutic treatments against this virus can be developed as quickly as possible.

Declarations

Ethics approval and consent to participate

Informed consent and Ethics approval were obtained from the medical ethics committee of the Baodi Clinical College of Tianjin Medical University.

Consent for publication

Written informed consent to publish this information was obtained from study participants.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

Yingchao Zhang¹, Zhentao Lin¹, Lijing Wang¹, Shuxiang Shan¹

YZ and SS designed the experiments. YZ, ZL and LW analyzed the raw data. YZ and SSL wrote the manuscript. All authors read and approved the final manuscript.

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Figures

Figure 1

Transverse chest computed tomograms from a 54 year old woman, showing ground glass opacity and consolidation of lower lobe of right lung near the pleura on day 1 after symptom onset (top panel), and bilateral ground glass opacity and consolidation on day 7 after symptom onset (bottom panel).