Research article

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Characteristics of patients with pneumonia caused by SARS-CoV-2 at the Department of Respiratory in Thong Nhat Hospital

Ngo The Hoang[1], Nguyen Duy Cuong[1], Pham Minh Tri[1], Hoang Thai Duong[1], Le Thi Quyen[1], Le Thi Diep[1], Le Phuong Ngan[2], Dung Si Ho[3], Le Dinh Thanh[3]

[1]Department of Respiratory, Thong Nhat Hospital

[2]Vietnamese-German Faculty Medicine, Pham Ngoc Thach University of Medicine

[3]Department of Geriatric Medicine, Faculty of Medicine, Pham Ngoc Thach University of Medicine

Abstract

Objective: To determine the characteristics of pneumonia caused by SARS-CoV-2 admitted to the Respiratory Department at Thong Nhat Hospital.

Methods: This cross-sectional study was conducted on 136 cases of confirmed pneumonia caused by SARS-CoV-2. Diagnosis of pneumonia caused by SARS-CoV 2 was by chest X-ray and/or CT scan. The main results included SARS-CoV-2 pneumonia symptoms and signs, blood test results, and chest x-ray results.

Results: There were 80 (58.8%) males and 56 (41.2%) females, mean age was 68.2 ± 10.5, and body mass index was 26.7 ± 6.2 kg/m2. Under 60 years old accounted for 35.3%, followed by 60-70 (22.1%), 71-80 (23.5%) and ≥80 (10.1%). Common comorbidities were hypertension (42.6%), diabetes (40.4%), and chronic lung disease (22.8%). Time onset of pneumonia was 7.5 ± 2.1 days from confirmed COVID-19. The proportion of people with bilateral pneumonia accounted for 72.1%. Common symptoms were fever, cough, shortness of breath, digestive disorders, muscle pain, fatigue, and headache. Oxygen saturation, c-reactive protein, and white blood cell count in the bilateral pneumonia group were 92.1 ± 2.3%, 81.5 ± 32.3 mg/L, and 9 ± 2.4 103/mm3, respectively, which were statistically significantly different compared to the unilateral pneumonia group. The rate of respiratory failure, pulmonary embolism, long hospital stay, and mortality were mainly significant in the group with bilateral pneumonia.

Conclusion: Pneumonia caused by SARS-CoV-2 mainly had symptoms of fever, cough, and shortness of breath. Bilateral pneumonia had a predominant rate and more severe clinical and paraclinical manifestations. Complications and mortality rates were higher when bilateral pneumonia was presented.

Keywords: SARS-CoV-2, pneumonia, comorbidities.

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Author contact:
Ngo The Hoang
Email: bshoanghhbvtn@gmail.com
Phone: 0908418109

1. INTRODUCTION

COVID-19 is a disease caused by SARS-CoV-2. In December 2019, this virus was identified as the cause of a cluster of pneumonia cases in Wuhan, China [1]. The World Health Organization declared COVID-19 a pandemic on March 11, 2020 [2]. By November 2021, more than 252 million patients were reported globally, with 5 million deaths [3].

The incubation period of SARS-CoV-2 can vary from 2 to 14 days. Nearly 80% of infected people have mild or no symptoms, and 20% have severe symptoms requiring hospital treatment. Severe symptoms usually appear between days 7 and 9 from clinical onset with typical symptoms such as fever, shortness of breath, and pneumonia on chest x-rays [4, 5]. Many studies have shown that

COVID-19 patients have diverse clinical manifestations from asymptomatic infection to severe pathological manifestations such as severe pneumonia, acute respiratory failure, acute respiratory distress syndrome (ARDS), sepsis and shock, infection, and multi-organ failure (5%) [6]. Pneumonia caused by SARS-CoV-2 accounts for 76.4% with an estimated mortality rate of 2.3% [6]. The diverse clinical picture makes diagnosis and treatment difficult. In Vietnam as of November 30, 2021, the total number of COVID-19 patients was 1,168,228 people, including 24,407 deaths.

Another feature of SARS-CoV-2 infection is the dissociation between clinical and imaging findings. Additionally, common laboratory features such as high c-reactive protein, lymphopenia, increased fibrinogen, and d-dimer are associated with thromboembolism. Risk factors for poor prognosis include hypertension, diabetes, obesity, and chronic cardiovascular and respiratory diseases [7, 8, 9].

This study aimed to (1) describe the characteristics of patients diagnosed with pneumonia related to SARS-CoV-2 and (2) compare differences between age groups as well as between unilateral versus bilateral pneumonia.

2. METHODS

2.1. Study design and participants

A cross-sectional study was conducted at Department of Respiratory in Thong Nhat Hospital, which is one of the most advanced hospitals in Ho Chi Minh City. There were 136 participants with a confirmed diagnosis of pneumonia related to SARS-CoV-2 (who did not agree to be vaccinated and had never had COVID-19) from April 2022 to June 2023.

2.2. Procedures

Participant’s selection criteria included:

- COVID-19 was diagnosed by detecting SARS-CoV-2 RNA using quantitative reverse transcription polymerase chain reaction (RT-PCR). Recover when there were 2 negative results 1 week apart.

- All participants had chest X-rays and/or chest CT scans to confirm pneumonia.

- Participants signed consent to voluntarily participate in the study.

Exclusion criteria included patients with lung damage before a positive COVID-19 PCR test or detected infection with other viruses, bacteria, or fungi at the time of pneumonia diagnosis.

The severity of pneumonia is divided into [10]:

- Pneumonia: fever, cough, difficulty breathing, rapid breathing > 20 times/minute, $SpO2 \geq 93\%$ when breathing air, lower respiratory tract infection with X-ray, ultrasound, or CT lung images showing pneumonia interstitium or detect complications consistent with COVID-19 pneumonia, treat oxygen supply through nasal cannula, HFNC, BiPAP.

- Severe pneumonia: fever or suspected respiratory infection, accompanied by any of the following signs: respiratory rate > 30 breaths/minute, severe dyspnea, or $SpO2 < 93\%$ on room air, ARDS status, mechanical ventilation invasion.

2.3. Statistical analysis

Data was processed with SPSS 16.0 for Windows software. Continuous variables are presented as mean ± standard deviation (SD) for normally distributed data. Categorical variables are presented as frequencies (%). A one-way ANOVA test was used to compare means between groups, and a chi-square test was used to analyze categorical variables. Statistical significance is accepted at p-value <0.05.

2.4. Ethics issues

Participants did not undergo any interventions. Personal information was kept confidential and only used for research purposes. Participants had the right to voluntarily participate or withdraw from the study at any time. The study was approved by the Scientific Committee, and Ethics Committee in Biomedical Research of Thong Nhat Hospital.

3. RESULTS

Table 1. Characteristics of participants by age groups

Characteristics	All	Age groups				p-value
		< 60	60 to < 70	70 to < 80	≥ 80	
Number of paticipants	136 (100)	48 (35.3)	30 (22.1)	32 (23.5)	26 (10.1)	0.062*
Age (years)	68.2 ± 10.5	56.3 ± 11.4	67.4 ± 14.3	75.6 ± 11.4	82.7 ± 13.2	-
Height (cm)	161.5 ± 3.7	152.1 ± 5.3	168.2 ± 4.6	166.5 ± 2.3	158.2 ± 4.9	0.329+
Weight (kg)	60.2 ± 6.1	56.3 ± 10.7	61.9 ± 6.4	61.6 ± 8.5	68.3 ± 11.7	0.082+
BMI (kg/m^2)	26.7 ± 6.2	24.8 ± 3.5	26.7 ± 4.3	25.8 ± 5.2	27.3 ± 10.3	0.043+
Sex						0.087*
Male	80 (58.8)	30 (62.5)	24 (57.1)	18 (64.3)	16 (61.5)	
Female	56 (41.2)	18 (37.5)	18 (42.9)	10 (35.7)	10 (38.5)	
Smoking						
No	54 (44.2)	20 (41.9)	10 (33.3)	10 (31.2)	14 (38.5)	0.456*
Have quit	46 (34.9)	10 (39.5)	12 (40)	18 (56.3)	6 (30.8)	0.382*
Still smoking	36 (20.9)	18 (18.6)	8 (26.7)	4 (12.5)	6 (30.8)	0.432*
Categorical variables are described as frequencies (percentages). Continuous variables are described by using mean ± standard deviation. *Chi-square test, +t-test. BMI Body mass index.						

Group of under 60 years old accounted for 35.3% and followed by 60-70 years old (22.1%), 71-80 years old (23.5%), and ≥ 80 years old (10.1%). There was a statistically significant difference in body mass index (BMI) between age groups (p = 0.043) (Table 1).

Table 2. Characteristics of comorbidities by age groups

Comorbidities	All	Age groups				p-value
		< 60	60 to < 70	70 to < 80	≥ 80	
Hypertension	58 (42.6)	21 (43.8)	10 (33.3)	13 (40.6)	11 (42.3)	0.578
Diabetes	55 (40.4)	19 (39.6)	10 (33.3)	14 (43.8)	12 (46.2)	0.426
Chronic lung disease	31 (22.8)	11 (22.9)	7 (23.3)	8 (25)	5 (19.2)	0.321
Dislipidemia	26 (19.1)	9 (18.7)	5 (16.7)	8 (25)	4 (15.4)	0.174
Coronary artery disease	25 (18.5)	9 (18.7)	5 (16.7)	7 (21.9)	4 (15.4)	0.532
Cancer	12 (8.8)	4 (8.3)	3 (10)	3 (9.4)	2 (7.7)	0.493
Chronic kidney disease	10 (7.4)	4 (8.3)	2 (6.7)	3 (9.4)	1 (3.8)	0.361
Data are shown as frequency (percentages). *Chi-square test.						

The most common comorbidity was hypertension (42.6%), followed by diabetes (40.4%), chronic lung disease (22.8%), dyslipidemia (19.1%), and coronary artery disease (18.5%). There were no statistically significant differences between age groups (Table 2).

Table 3. Difference between unilateral and bilateral pneumonia caused by SARS-CoV-2

Characteristics	Unilateral pneumonia	Bilateral pneumonia	p-value
Number of paticipants	38 (27.9)	98 (72.1)	0.043*
Mean-day onset of pneumonia	7.52 ± 1.7	7.67 ± 1.23	0.053+
Symptoms			
Fever	30 (78.9)	79 (80.6)	0.78*
Cough	29 (76.3)	80 (81.6)	0.62*
Shortness of breath	20 (52.6)	60 (61.2)	0.26*
Digestive disorders	14 (36.8)	27 (27.6)	0.32*
Muscle pain	13 (34.2)	26 (26.5)	0.28*
Fatigue	10 (26.3)	27 (27.6)	0.22*
Headache	9 (23.7)	27 (27.5)	0.83*
Insomnia	8 (2.10)	8 (0.80)	0.54*
Swallowing pain	6 (15.8)	15 (15.3)	0.61*
Chest pain	5 (13.2)	3 (3.10)	0.016*
Taste disturbance	2 (5.3)	5 (5.1)	0.65*
Loss of smell	1 (2.6)	3 (3.1)	0.42*
Signs			
Pulse (beats/minute)	93.2 ± 16.1	93.3 ± 16.5	0.072+
Temperature (oC)	37.2 ± 1.1	37.4 ± 1.5	0.061+
Breathing rate (times/minute)	16.1 ± 1.4	22.2 ± 3.1	0.028+
Pulmonary rales	13 (27)	21 (26)	0.026*
SpO2 (%)	94.6 ± 2.1	92.1 ± 2.3	0.031+
Blood test results			
CRP (mg/L)	37.5 ± 21.3	81.5 ± 32.3	0.034+
WBC (103/mm3)	1.25 ± 1.5	9 ± 2.4	0.002+
D-Dimer (g/L)	410 ± 11.3	464 ± 32.3	0.31+
Fibrinogen (mg/dL)	31 ± 17.3	34 ± 22.1	0.27+
Treatments			
Respiratory failure	8 (21.1)	32 (32.7)	0.038*
Pulmonary embolism	0 (0.0)	6 (6.1)	0.001*
Mean-day of treatment	6.2 ± 3.1	15.3 ± 1.5	0.046+
Mortality	1 (0.02)	8 (8.2)	0.043*

Categorical variables are described as frequencies (percentages). Continuous variables are described by using mean ± standard deviation. *Chi-square test, +t-test. CRP c-reactive protein, WBC white blood cell.

Participants with bilateral pneumonia were dominant, accounting for 72.1%. Common symptoms were fever, cough, shortness of breath, digestive disorders, muscle pain, fatigue, and headache. However, there was no difference between the unilateral and bilateral pneumonia groups (Table 3). Oxygen saturation was lower in the bilateral pneumonia (92.1 ± 2.3% vs 94.6 ± 2.1%). C-reactive protein (CRP) and white blood cell count were higher in the bilateral pneumonia group. Complications of respiratory failure, pulmonary embolism, long hospital days, and mortality were mainly in the group with bilateral pneumonia (32.7%, 6.1%, 15.3 ± 1.5 days and 8.2%, respectively). All were statistically significant differences between the 2 groups (Table 3).

4. DISCUSSIONS

In this study, females accounted for 41.2% of the participants. The age distribution is disproportionate. The group under 60 years old accounted for 35.3%, followed by 60-70 years old (22.1%), 71-80 years old (23.5%), and >80 years old (10.1%). There was a statistically significant difference in BMI between age groups (Table 1). The proportion of participants with bilateral pneumonia was higher, accounting for 72.1% (Table 2). Several studies have reported advanced age as a factor in the development of severe illness due to SARS-CoV-2 infection [8, 11]. This study was in line with prior observation because elderly patients had bilateral pneumonia more frequently when compared to younger patients. However, elderly people often have fewer symptoms and comorbidities may also overlap with some COVID-19 symptoms [12]. Common comorbidities were hypertension (42.6%), diabetes (40.4%), chronic lung disease (22.8%), dyslipidemia (19.1%), and coronary artery disease (18.5%) (Table 2). These results were similar to published studies [8, 9, 11]. Besides, a meta-analysis found that patients infected with SARS-CoV-2 had hypertension (21.1%) and diabetes (9.7%) as the most common comorbidities [8]. Smoking accounted for a fairly high rate in this study (12.6%), which was higher than the results of Guan et al [4].

Common symptoms were fever, cough, shortness of breath, digestive disorders, muscle pain, fatigue, and headache. But there was no difference between unilateral and bilateral pneumonia groups, consistent with the literature [5, 8, 13, 14]. In this study, the elderly had fewer symptoms, which is the same with some results of other studies [11, 15]. In this study, the diagnosis of pneumonia was at day 7.5 ± 2.1 from the onset of symptoms, similar to Wang [16].

Oxygen saturation was lower in the bilateral pneumonia group. CRP and white blood cell count in the bilateral pneumonia group were 81.5 ± 32.3 mg/L and 9 ± 2.4 103/mm3, respectively. In this study, CRP was significantly higher in patients with severe pneumonia caused by COVID-19. These results were in line with those of some other studies [11, 17].

Complications of respiratory failure, pulmonary embolism, and mortality mainly occurred in the group with bilateral pneumonia with statistically significant differences between the 2 groups. Most studies do not compare differences between age groups. Niu et al. showed that oxygen saturation decreased to 90.6% and mortality rate accounted for 18.8% in patients ≥80 years old [15].

This study described two clinical patterns by chest X-ray: unilateral and bilateral pneumonia. As the results, 72.1% of pneumonia cases were bilateral similar to the results of other publications, in which approximately 75% of pneumonia cases were bilateral and 25% were unilateral [10, 18, 19, 20]. Bilateral pneumonia is more common in severe cases [4, 11, 18]. Unilateral pneumonia is more frequent in younger patients and has a later onset than bilateral pneumonia [4, 21]. Besides, unilateral pneumonia has better blood test results [4, 21].

5. CONCLUSION

Pneumonia caused by SARS-CoV-2 mainly had symptoms of fever, cough, and shortness of breath. Bilateral pneumonia had a predominant rate which was more severe clinical and paraclinical manifestations. Complications and mortality rates were higher when bilateral pneumonia was presented.

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