Original Article

Clinical and laboratory findings of COVID-19: A systematic review and meta-analysis

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Background/purpose: The aim of this study was to systematically review all COVID-19 publications to summarize the clinical features, assess comorbidities, prevalence, and disease outcomes.
Methods: Included were all COVID-19 published studies between January 1 to July 20, 2020. The random effect model was used to calculate the pooled prevalence and corresponding 95% confidence interval (CI). Publication bias was assessed using the funnel plot for the standard error by logit event.
Results: The mean age of the patients was 46.8 years (95% CI, 41.0—52.6) and males comprised 54.0% (95% CI, 51.3—56.7). Total co-morbidities prevalence was 29.5% (95% CI, 19.0—36.6), with diabetes mellitus being the most prevalent 13.8% (95% CI, 8.7—21.1), followed by hypertension 11.7% (95% CI, 5.7—22.6), and cardiovascular disease 9.7% (95% CI, 6.5—14.2). The most common clinical manifestations were fever, 82.0% (95% CI, 67.7—90.8), cough 54.3% (95% CI, 45.5—62.9), fatigue 30.2% (95% CI, 23.3—38.1), sputum 28.5% (95% CI, 21.2—37.2), sore throat 21.7% (95% CI, 14.6—31.0), and headache 11.0% (95% CI, 7.9—15.2). The most common COVID-19 serious complications were RNA Anemia 98.2% (95% CI, 96.2—99.2), hospitalization 83.7% (95% CI, 76.0—89.3), bilateral pneumonia 70.9% (95% CI, 58.2—81.0); of those hospitalized 43.5% (95% CI, 24.9—64.2) were discharged. Fatality accounted for 10.5% (95% CI 6.8—16.1).
Conclusion: Patients infected with COVID-19 coronavirus showed a wide range of clinical presentation with non-specific symptoms.

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Introduction

The common human coronaviruses are usually harmless viruses causing mild illnesses, such as the common cold.[1] However, certain types of coronaviruses infect the lower respiratory airways, and are causing pneumonia and bronchitis.[2] Coronaviruses structure, as seen under an electron microscope, have large single-stranded RNA genomes at its center, surrounded by a spherical fatty outer layer, with a crown or "corona" of club-shaped spikes on its surface.[2]

The new coronavirus, SARS-CoV-2, which causes COVID-19 appears to have first emerged in Wuhan, China, in late 2019. The outbreak has since spread across China to other countries around the world. By the end of January 2020, the World Health Organization (WHO) declared the new coronavirus a public health emergency of international concern.[3]

Reported COVID-19 symptoms range from mild to severe. The most common symptoms include fever, dry cough, tiredness, runny nose, and sore throat.[4] Severe COVID-19 cases may develop difficulty breathing, organ failure, and consequently requiring critical care respiratory ventilation with specialized management at intensive care units (ICU), and the most severe complication death.[3,5—10]

Similarities in the epidemiology, clinical features, and management have been reported in SARS, MERS, and COVID-19 coronaviruses.[5,7,11—13] These coronaviruses are enveloped by a positive-stranded RNA isolated from bats sharing sequence homology with isolates from humans, suggesting bats as the natural host and reservoir.[11,12,14] Differences in these coronaviruses have been noted in their clinical picture. Cough frequency was reported highest in SARS (92.1%),[15] than in MERS (72%) patients,[16] and COVID-19 (57.6%).[14] On the other hand, diarrhea was reported in 20—25% of SARS and MERS patients, and as low as 7% in COVID-19 patients.[7,9,12,17] The case-fatality rate (3.5%) of COVID-19 has been reported to be much lower than that of SARS (9.6%) and MERS (34.4%).[18]

Several studies on the emergence of COVID-19 have been published in China and other countries.[8,19—21] Studies have reported clinical findings, evolution, outcome of the disease, potential risk factors, laboratory and image findings. However, the literature still lacks systematic review that consolidates clinical and laboratory findings. The aim of this systematic review and meta-analysis is to summarize the currently available clinical features of COVID-19 and to examine the outcome of its cases.

Methods

Protocol

The protocol was developed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P), the reporting used the PRISMA checklist and registered with PROSPERO register (registration number CRD42020199625).

Information sources and search strategy

The databases PubMed, EMBASE, Cochrane, Scopus, and Google scholars were reviewed from January 1 to July 20, 2020, to identify relevant COVID-19 English language published studies. The Medical Subject Headings (MeSH) terms selected included" *Novel coronavirus 2019"*, *"2019 nCoV"*, *"COVID-19"*, *"Wuhan coronavirus,"* *Wuhan pneumonia,"* and *"SARS-CoV-2."* The search strategy used the PICO framework: P (Population, children and adult patients with COVID-19), I (Intervention or exposure for observational studies, exposure to SARS-CoV), C (Comparison, recovered and non-recovered cases), and O (Outcome, cure rate).

Eligibility criteria

Included in the analysis were published peer-reviewed articles from January 1 to July 20, 2020, that reported cases of confirmed SARS-CoV-2. Excluded from the analysis were studies reporting COVID-19 cases with incomplete information.

Data collection

The following was retrieved from each published article: name of authors, date of publication, study location, aims and objectives, source of participants, number of patients, study design, population demographic data (gender and age), eligibility criteria, comorbidities, measurement of exposure and outcome; clinical, laboratory findings, CT imaging features, and follow-up data, and treatment outcomes.

Quality of the studies

The recommended Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist,[22] was used to assess the risk of bias in all identified full-text articles. The quality of the included studies was assessed independently by two authors (FQ, KB). Twelve checklist criteria were selected and articles were classified into one of three categories of bias: (1) low-risk, where 9 out of 12 criteria were selected, (2) moderate risk, 6 to 8 criteria were selected, and (3) high-risk, only 5 criteria were selected (Table 1).

Statistical analysis

Meta-Analysis was used to analyse the data using the comprehensive Meta-Analysis (CMA) package, version 3. Percentages were calculated to describe the distribution of the categorical dichotomous variables. For continuous data, the mean and 95% confidence intervals (CI) were calculated. Studies reporting the mean with 95% CI, the formula (upper limit-lower limit)/4 was used to extract the standard deviation.

Meta-Analysis using the random-effect model was performed to estimate the pooled prevalence and 95% CI. Pooled percentage, prevalence, and corresponding 95% CI were calculated to summarize the weighted effect size for all binary variables. The measure of heterogeneity reported included the Cochran's Q statistics, I^2 index with the level of heterogeneity defined as poor< 25, moderate >50, and high> 75, and the tau square (T^2) test. Publication bias was assessed with a funnel plot and the Egger test.

Results

Study selection and characteristics

Figure 1 shows the literature retrieval flowchart. Five databases (PubMed, EMBASE, Cochrane database, Scopus, and Google Scholar) were searched from January 1 to July 20, 2020. One-hundred and eighteen studies were identified using the predefined search strategy and manual search. Eight duplicate studies were excluded and 71 did not meet the eligibility criteria, such as meta-analysis, review, or mechanism of COVID-19 infection. For this reason, forty-one studies were selected for full-text review. After revision, 6 studies were excluded due to lack of information, comment, or viewpoint.

The final analysis included 35 studies published between January 1 to July 20, 2020. Following the checklist criteria, all 35 screened articles were ranked as low risk of bias, with a weighted kappa statistic between author agreements of

Table 1 Quality assessment of the included articles (N = 35).

Author	Date of Publication	Country	Study Design	Total Patients	Quality Assessment Score
Chung et al.[24]	2/04/2020	China	Cross-Sectional	21	10
Chen et al.[11]	2/06/2020	China	Cross-Sectional	29	11
Wang et al.[25]	2/07/2020	China	Cross-Sectional	138	9
Kui et al.[26]	2/07/2020	China	Cross-Sectional	137	11
Chang et al.[27]	2/07/2020	China	Cross-Sectional	13	9
To et al.[28]	2/12/2020	China	Cross-Sectional	12	10
COVID-19 team[29]	2/12/2020	Australia	Cross-Sectional	15	11
Yueying et al.[30]	2/13/2020	China	Cross-Sectional	63	9
Li et al.[31]	2/13/2020	China	Case-Series	24	11
Feng et al.[32]	2/13/2020	China	Case-Series	21	9
Liang et al.[33]	2/14/2020	China	Cross-Sectional	1590	10
Zhang et al.[34]	2/15/2020	China	Case-Series	9	10
Feng et al.[35]	2/17/2020	China	Case-Series	15	11
Wang et al.[17]	2/17/2020	China	Cross-Sectional	34	9
Xiaobo et al.[36]	2/21/2020	China	Cross-Sectional	52	10
Zhou[37]	28/3/2020	China	Cohort, Retrospective	191	11
Qiu H.[38]	25/3/2020	China	Cohort, Prospective	36	11
Wang et al.[39]	12/3/2020	China	Case-Study	1	9
Xia[40]	5/03/2020	China	Cohort, Retrospective	20	9
Wan et al.[41]	21/3/2020	China	Cohort, Retrospective	135	10
Liu et a.[42]	27/3/2020	China	Cohort, Retrospective	56	10
Zhao[43]	12/3/2020	China	Cohort, Retrospective	19	10
Zhou et al.[10]	05/3/2020	China	Cohort, Retrospective	62	11
Wang 44	16/3/2020	China	Cohort, Retrospective	69	10
Lei et al.[45]	5/4/2020	China	Cross-Sectional	20	10
Lei Pan et al.[46]	14/4/2020	China	Cross-Sectional	204	9
Fan et al.[47]	21/4/2020	China	Cross-Sectional	150	10
Richardson et al.[48]	22/4/2020	USA	Case Series	5700	10
Li et al.[49]	15/5/2020	China	Cohort, Retrospective	93	9
Hong et al.[50]	7/4/2020	South Korea	Cohort, Retrospective	98	11
Garazzino et al.[51]	7/5/2020	Italy	Cross-Sectional	168	10
Zacharia et al.[52]	3/6/2020	USA	Case series	50	9
Matos et al.[53]	26/6/2020	Italy	Cross-Sectional	106	11
Li et al.[54]	11/6/2020	China	Cohort, Retrospective	102	10
Alsofayan et al.[55]	31/5/2020	KSA	Cross-Sectional	1519	11
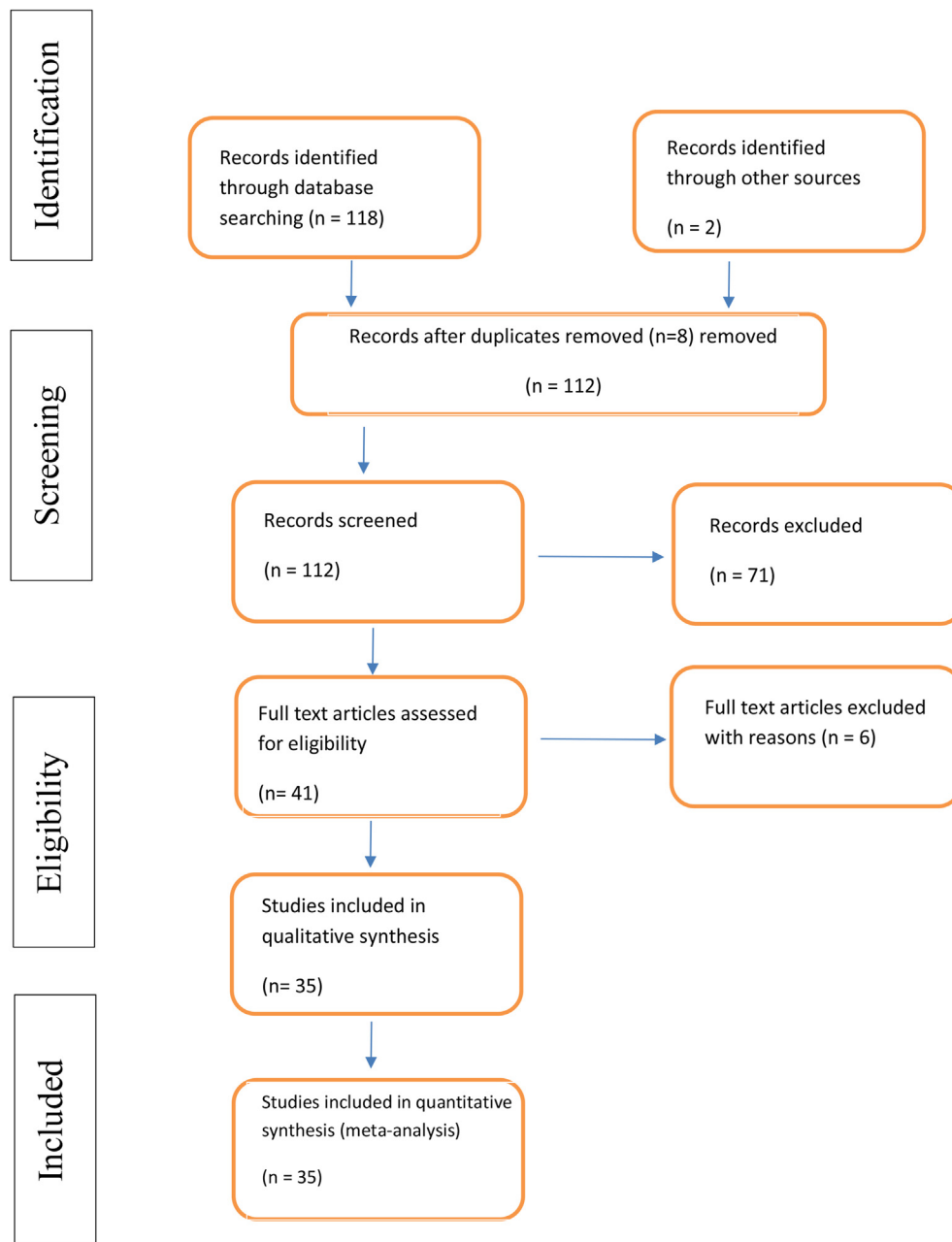
Figure 1 PRISMA chart of the selected studies.

87%. The study designs were either cross-sectional or cohort (Table 1).

Twenty-nine variables were included in the Meta-Analysis (Tables 2−5). Most of the studies showed considerable heterogeneity ($I^2 > 75\%$) (Table 6). No evidence of bias as demonstrated by Egger's test (P-value > 0.05) (Table 6).

Demographic characteristics

The total number of patients analyzed was 10,972. The mean age of the patients across the studies was 46.8 years (95% CI, 41.0−52.6) and males comprised 54% (95% CI, 51.3−56.7) of the population (Table 6).

Co-morbidities

The total prevalence of co-morbidities in the 17 included studies was 29.5% (95% CI, 19.0−36.6), the most prevalent being diabetes mellitus (DM) 13.8% (95% CI, 8.7−21.1), hypertension 11.7% (95% CI, 5.7−22.6), cardiovascular disease (CVD) 9.7% (95% CI, 6.5−14.2), and chronic obstructive pulmonary disease (COPD) 3.9% (95% CI, 2.9−5.3) (Table 6).

Clinical manifestations

The clinical manifestations of patients diagnosed with COVID-19 included fever, 82.0% (95% CI, 67.7−90.8), cough 54.3% (95% CI, 45.5−62.9), fatigue 30.2% (95% CI,

Table 2 Demographic details and comorbidities associated with COVID-19 patients (N = 35).

Author	Mean age (years)	Age range (years)	Gender	No. of patients in ICU (%)	Comorbidities No. (%)	Diabetes No. (%)	Hypertension No. (%)	CVD No. (%)	COPD No. (%)
Chung et al.[24]	51	29–77	13 M	a	a	a	a	a	a
Chen et al.[11]	56	26–79	21 M	a	16 (55.2)	5 (17.2)	8 (27.6)	a	a
Wang et al.[25]	56	42–68	75 M	36 (26.1)	64 (46.4)	14 (10.1)	43 (31.2)	20 (14.5)	4 (2.9)
Kui et al.[26]	57	20–83	61 M	a	27 (19.7)	14 (10.2)	13 (9.5)	10 (7.3)	2 (1.5)
Chang et al.[27]	34	34–48	10 M	a	a	a	a	a	a
To et al.[28]	62.5	37–75	7 M	a	a	a	a	a	a
COVID-19 team[29]	43	8–66	9 M	1 (6.7)	a	a	a	a	a
Yueying et al.[30]	a	15.2	33 M	a	a	a	a	a	a
Li et al.[31]	43	412–48	8 M	a	a	a	a	a	a
Feng et al.[32]	40.9	25–63	6 M	a	a	a	a	a	a
Liang et al.[33]	a	a	911 M	130 (8.2)	18 (1.1)	2 (0.1)	2 (0.1)	a	1 (0.06)
Zhang et al.[34]	36	15–49	5 M	a	1 (11.1)	1 (11.1)	a	a	a
Feng et al.[35]	a	4–14	5 M	a	a	a	a	a	a
Wang et al.[17]	8	a	14 M	a	a	a	a	a	a
Xiaobo et al.[36]	59.7	33.6–85.8	35 M	a	21 (40.4)	9 (17.3)	a	5 (9.6)	4 (7.7)
Zhou[37]	56	18–87	119 M 72 F	50 (26)	91 (48)	36 (19)	58 (30)	15 (8)	6 (3)
Qiu H.[38]	8.3	0–16	23 M 13 F	a	a	a	a	a	a
Shaoshuai W et al.[39]	a	a	1 F, 1M (neonatal)	0	a	a	a	a	a
Xia[40]	2.15	0–14	13 M 7 F	a	a	a	a	a	a
Wan et al.[41]	47	36–55	63 F 73 M	a	a	43	12	13	7
Liu et a.[42]	47	a	a	a	a	19	4	10	2
Zhao[43]	48	27–56	8 F 11 M	a	0	3	0	2	0
Zhou et al.[10]	52.8	30–77	23 F 39 M	a	a	12	4	4	a
Wang[44]	42	a	37 F 32 M	a	a	35	7 (10)	9 (13)	8 (12)
Lei et al.[45]	43.2	25–64	10 M 10 F	1 (5.0)	3 (15.0)	a	a	5 (25.0)	1 (5.0)
Lei Pan et al.[46]	52.9	a	107 M 97 F	16 (7.8)	13 (6.37)	a	a	44 (21.6)	9 (4.4)
Fan et al.[47]	56	17–90	68 M 82 F	a	69 (46.00)	a	a	a	a
Richardson et al.[48]	56	52–75	3437 M 2263 F	373 (14.2)	28%	1808 (33.8)	3026 (56.6)	966 (18)	287 (5.4)
Li et al.[49]	51.0	a	41 M 52F	a	32 (34)	11 (12)	5 (5)	4 (4)	8 (9)

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Study	Mean age	Age range	Sex						
Hong et al.[50]	55.4	21–65	38 M / 60 F	13 (13.3)	9 (9.2)	38 (38.8)	30 (30.6)	11 (11.2)	
Garazzino et al.[51]	a	1–17	94 M / 74 F	2 (11.1)	a	32 (19.6)	a	a	
Zacharia et al.[52]	a	6–21	27 M / 23 F		3 (6)	33 (60)	a	a	
Matos et al.[53]	a	26–95	65 M / 41 F	a	a	40/106 (37.7)	a	a	
Li et al.[54]	a	45–70	59 M / 43 F	15 (15)	44 (43)	31 (30)	4 (4)	2 (2)	
Alsofayan et al.[55]	a	14–66	825 M / 694 F	36 (4.7)	83 (5.46)	1095 (72)	97 (6.4)	25 (1.6)	57 (3.75)

No, number; ICU, intensive care unit; CVD, cardiovascular disease; COPD, chronic obstructive pulmonary disease; M, male; F, female.
a Data not available.

23.3—38.1), sputum 28.5% (95% CI, 21.2—37.2), sore throat 21.7 (95% CI, 14.6—31.0), headache 11.0% (95% CI, 7.9—15.2), and hemoptysis 5.3% (95% CI, 3.0—8.9) (Table 6).

Laboratory findings

Results of blood investigations showed high levels of lactate dehydrogenase (LDH) 51.5% (95% CI, 40.3—62.6), lymphopenia 41.9% (95% CI, 30.1—54.7), C-reactive protein (CRP) 48.1% (95% CI 29.8—66.9), erythrocyte sedimentation rate (ESR) 23.5% (95% CI, 11.1—42.9), leukopenia 16% (95% CI, 9.5—25.7), leukocytosis 7.5% (95% CI, 4.5—12) and high levels of creatinine 7.7% (95% CI, 3.2—17.3) (Table 6).

Complications

RNA Anemia was the most dominant complication 98.2% (95% CI, 96.2—99.2), followed by hospitalization 83.7% (95% CI, 76.0—89.3), bilateral pneumonia 70.9% (95% CI, 58.2—81.0), unilateral pneumonia 26.2 (95% CI, 14.6—42.2), acute respiratory distress syndrome (ARDS) 23.6% (95%CI, 12.9—39.2), shock 8.5% (95% CI, 4.4—10.8) and death 10.5% (95% CI, 6.8—16.1). From those hospitalized 43.5% (95% CI, 24.9—64.2) were cured and discharged (Table 6).

Discussion

In this study, we analyzed the clinical characteristics of 10,972 confirmed cases infected with novel coronavirus (2019-nCoV) using systematic review and random-effects meta-analysis. The mean age in this study was similar to other published studies that showed that 2019-nCoV mainly infects middle-aged and elderly.[7,56,57] Similar trends were reported for SARS patients where the median age was 52 (25, 78) years and age (per 1-year increase) was reported as a risk factor for death.[58] Another study showed that the median age of MERS non-survivors was 62 (53, 73) which is older than the survivors of the disease 46 (35, 57) years.[16] One of the possible reasons for this phenomenon is that lung aging is associated with an inability of lung cells to multiply resulting in structural and functional changes in the respiratory tract, giving rise to decreased lung function, altered pulmonary remodeling, diminished regeneration, and enhanced susceptibility to pulmonary disease.[59] It is also reported that the older patients have a higher risk of acute respiratory distress syndrome (ARDS) development.[60] This beta coronavirus has been reported to cause ARDS and can be transmitted between humans.[5] It is speculated to use the angiotensin-converting enzyme (ACE) 2 as a receptor for cell invasion.[41] For this reason, some of the 2019-nCoV patients showed rapid progression of lung lesions, which might have led to death.

In the current study, 29.5% of the patients presented with comorbidities, such as CVD (9.7%), hypertension (11.7%), DM (13.8%), and COPD (3.9%). The comorbidities, particularly the CVD and COPD, were considered by some authorities to predict the in-hospital mortality in critically ill patients.[61] It is thought that diabetes may increase the risk of infection and can delay the recovery of the infectious illnesses. In this study, only, 13.8% of patients were

Table 3 Clinical feature of COVID-19 patients (N = 35).

Author	No.	Fever No. (%)	Cough No. (%)	Sore Throat No. (%)	Fatigue No. (%)	Sputum No. (%)	Headache No. (%)	Hemoptysis No. (%)
Chung et al.[24]	21	14 (66.7)	9 (42.9)	a	6 (28.6)	a	3 (14.3)	a
Chen et al.[11]	29	28 (96.6)	21 (72.4)	a	12 (41.4)	21 (72.4)	2 (6.9)	a
Wang et al.[25]	138	136 (98.6)	82 (59.4)	24 (17.4)	138 (100)	37 (26.8)	9 (6.5)	a
Kui et al.[26]	137	112 (81.8)	66 (48.2)	a	44 (32.1)	6 (4.4)	13 (9.5)	7 (5.1)
Chang et al.[27]	13	12 (9.3)	6 (46.2)	a	3 (23.1)	2 (15.4)	3 (23.1)	a
To et al.[28]	12	a	a	a	a	a	a	a
COVID-19 team[29]	15	14 (93.3)	11 (73.3)	a	a	a	a	a
Yueying et al.[30]	63	a	a	a	a	a	a	a
Li et al.[31]	24	19 (79.2)	6 (25)	a	6 (25.0)	a	4 (16.7)	a
Feng et al.[32]	21	18 (85.7)	12 (57.1)	4 (19.0)	11 (52.4)	6 (28.6)	a	a
Liang et al.[33]	1590	a	a	a	a	a	a	a
Zhang et al.[34]	9	8 (88.9)	5 (55.6)	4 (44.4)	4 (44.4)	a	a	a
Feng et al.[35]	15	5 (33.3)	1 (6.7)	a	a	a	a	a
Wang et al.[17]	34	17 (50.0)	13 (38.2)	a	a	a	a	a
Xiaobo et al.[36]	52	51 (98.1)	40 (76.9)	a	6 (76.9)	a	3 (11.5)	a
Zhou[37]	191	180 (94)	151 (79)	a	44 (23)	44 (23)	a	a
Qiu et al.[38]	36	13 (36)	7 (21)	2 (6)	a	a	3 (8)	a
Shaoshuai W et al.[39]	2	1 (50)	0	0	0	0	0	0
Xia[40]	20	12 (60)	13 (65)	1 (5)	1 (5)	a	a	a
Wan et al.[41]	135	120	102	a	a	12	34	4
Liu et al.[42]	56	44	21	a	5	21	a	a
Zhao[43]	19	15	15	4	2	a	2	a
Zhou et al.[10]	62	53	28	a	14	28	a	a
Wang[44]	69	40 (78)	38 (55)	a	29 (42)	a	a	a
Lei et al.[45]	20	16 (80.0)	11 (55.0)	4 (20.0)	7 (35.0)	a	a	a
Lei Pan et al.[46]	204	95 (92.23)	a	a	54 (52.42)	a	a	a
Fan et al.[47]	150	122 (81.33)	99 (66.00)		33 (22.0)		6 (4.0)	
Richardson et al.[48]	5700	5644	a	a	a	a	a	a
Li et al.[49]	93	89 (96)	66 (71)	a	63 (68.0)	29 (31)	a	a
Hong et al.[50]	98	62 (63.3)	58 (59.2)			39 (39.8)		
Garazzino et al.[51]	168	138 (82.1)	82 (48.8)	a	a	a	a	a
Zacharia et al.[52]	50	40 (80)	23 (46)	6 (12)	a	a	a	a
Matos et al.[53]	106	a	a	a	a	a	a	a
Li et al.[54]	102	94 (92)	77 (75)		35 (34)	26 (25)		5 (5)
Alsofayan et al.[55]	1519	333 (85.6)	429 (89.4)	257 (81.6)			193 (27.3)	

No, number.

a Data not available.

found to have DM and there is no evidence that DM complicated their recovery status. Recent studies also showed that diabetes had no significant correlation with the initiation, progression, and prognosis of ARDS.[62,63] A hypothesis is that there are more hypertensive patients who developed the 2019-CoV infection, which is related to the ACE inhibitors used in these patients which could indirectly increase the cellular ACE2 receptors, which may be the receptors for 2019-CoV. However, the exact roles of age and underlying disease played in the development and progression of novel coronavirus pneumonia require further investigation.

In this study, the clinical manifestations of patients diagnosed with COVID-19 infection most commonly includes fever (82.0%) and cough (54.3%). Other studies also reported that fever is the most observed symptom among the effected patients, furthermore, fever frequency is similar in SARS and MERS.[64–67] However, cough frequency was highest in SARS (92.1%),[15] followed by MERS MERS (72%),[16] and least in this COVID-19 study [54.3%]. Other clinical manifestations such as fatigue (30.2%), sputum (28.5%), sore throat (21.7%), headache (11.0%), and hemoptysis (5.3%) were also reported in this study. Similar observations have also been reported by other investigators,[68,69] nevertheless, these clinical symptoms are rather non-specific and may mimic influenza or atypical pneumonia of other causes such as mycoplasma, chlamydia, and legionella.

In this study, results of blood investigations showed lymphopenia (41.9%), CRP (48.1%), elevated ESR (23.5%), leukopenia (16.0%), leukocytosis (7.5%), and high creatinine (7.7%). The increased white blood cell (WBC) count suggesting that comorbid bacterial or fungal infection might have occurred in these patients. Similar to previous

Table 4 Investigations of COVID-19 patients (N = 35).

Author	No.	Leukocytosis No. (%)	Leukopenia No. (%)	Lymphopenia No. (%)	High Creatinine No. (%)	High LDH No. (%)	High CR No. (%)	ESR elevated No. (%)
Chung et al.[24]	21	a	a	a	a	a	a	a
Chen et al.[11]	29	6 (20.7)	6 (20.7)	20 (69.0)	2 (6.9)	20 (6.9)	27 (93.1)	a
Wang et al.[25]	138	0	0	97 (70.3)	a	55 (39.9)	a	a
Kui et al.[26]	137	26 (19.0)	51 (37.2)	99 (72.3)	a	a	a	a
Chang et al.[27]	13	a	a	a	a	a	a	a
To et al.[28]	12	a	a	a	a	a	a	a
COVID-19 team[29]	15	a	a	a	a	a	a	a
Yueying et al.[30]	63	a	a	a	a	a	a	a
Li et al.[31]	24	a	a	a	a	a	a	a
Feng et al.[32]	21	a	a	a	a	a	a	a
Liang et al.[33]	1590	a	a	a	a	a	a	a
Zhang et al.[34]	9	1 (11.1)	a	2 (22.2)	a	a	5 (55.6)	a
Feng et al.[35]	15	a	8 (53.3)	a	a	a	a	a
Wang et al.[17]	34	5 (14.7)	1 (2.9)	1 (2.9)	a	10 (29.4)	1 (2.9)	5 (14.7)
Xiaobo et al.[36]	52	a	a	a	a	a	a	a
Xia et al.[40]	20	2 (10)	4 (20)	7 (35)	a	a	9 (45)	a
Zhou et al.[37]	191	40 (21)	32 (17)	77 (40)	8 (4)	123 (67)	a	a
Qiu et al.[38]	36	a	7 (19)	11 (31)	0 (0)	a	1 (2.)	0 (0)
Wan et al.[41]	135	9 (6.67)	28 (20.)	68 (50.4)	6 (4.4)	58 (43)	40 (29.6)	a
Liu et al.[42]	56	4 (7.1)	11 (19.6)	17 (30.4)	a	a	a	a
Zhao et al.[46]	19	2 (5.9)	11 (32.4)	22 (64.7)	a	6 (17.6)	30 (88.2)	a
Zhou et al.[10]	62	a	6 (20.0)	24 (80.0)	a	a	27 (100)	18 (66.7)
Wang et al.[44]	69	1 (1)	36 (54)	28 (42.0)	a	25 (41)	6 (10%)	30 (52)
Lei et al.[45]	20	a	a	a	1 (5.0)	a	a	a
Lei Pan et al.[46]	204	a	a	a	a	a	a	a
Fan et al.[47]	150	2 (1.33)	34 (22.67)	79 (52.67)	a	a	a	a
Richardson et al.[48]	5700	a	a	3387 (60)	a	4003	4517	a
Li et al.[49]	93	a	a	a	a	a	a	a
Hong et al.[50]	98	9 (9.2)	18 (18.4)	40 (40.8)	29 (29.6)	47 (50.5)	61 (67.8)	a
Garazzino et al.[51]	168	a	a	a	a	a	a	a
Zacharia et al.[52]	50	a	a	36 (72)	a	a	a	a
Matos et al.[53]	106	a	a	a	a	a	a	a
Li et al.[54]	102	16 (15)	11 (11)	66 (65)	13 (13)	75 (74)	86 (84)	a
Alsofyan et al.[55]	1519	3 (3.5)	9 (10.6)	24 (37.5)	a	a	a	a

No, number; LDH, Lactate dehydrogenase; ESR, erythrocyte sedimentation rate.

[a] Data not available.

studies, this study found that patients had lower lymphocyte count and lymphocyte percentage. Previous studies found that during the acute phase of SARS-CoV infection in humans, the blood lymphocyte counts were decreased.[70—72] Another study suggested that lymphocyte cells may play protective roles in coronavirus infection.[73] Lower lymphocytes counts may be because the viral infection causes persistent consumption and/or insufficient regeneration of lymphocytes. Similar to previous study, the level of CRP in patients infected with 2019-nCoV is high.[5] Moreover, CRP was a significant predictor for disease severity in SARS.[74]

In this study, RNA anemia (98.2%) was the most dominant complication of patients infected with COVID-19, followed by patients requiring hospitalization (83.7%), and bilateral pneumonia (70.9%). Furthermore, other

studies reported that 45% of patients showed signs of pulmonary fibrosis within one month after being infected with SARS-CoV.[75] Another study found lung fibrosis in 33% of patients who have recovered from MERS-CoV.[76] It is possible that pulmonary fibrosis will become one of the serious complications in patients with 2019-nCoV infection.[77]

In this study 10.5% of patients died and similar numbers were recovered and discharged from the hospital. In comparison with data from other countries, for example, in South Korea the case fatality rate (10.4%) was in patients aged 80 years and over, in the 70 year-age group (5.4%), in the 60—69 years (1.51%), in the 50 year age-group (0.37%). Even lower rates were seen in the younger population, dropping to zero in those 29 years and younger,[78] likewise, in China, the case fatality rate was higher in the early

Table 5 Clinical manifestations and complications from COVID-19 (N = 35).

Author	No.	Unilateral Pneumonia No. (%)	Bilateral Pneumonia No. (%)	Ground Glass opacity No. (%)	Acute Respiratory distress No. (%)	RNA Anemia No. (%)	Shock No. (%)	Hospitalization No. (%)	Discharge No. (%)	Death No. (%)
Chung et al.[24]	21	2 (1.5)	16 (11.8)	18 (13.2)	a	21 (15.4)	a	21 (15.4)	a	a
Chen et al.[11]	29	a	a	29 (100)	a	29 (100)	a	27 (9.1)	a	2 (6.9)
Wang et al.[25]	138	0 (0)	138 (100)	138 (100)	27 (19.6)	138 (100)	12 (8.7)	138 (100)	47 (34.1)	6 (4.3)
Kui et al.[26]	137	a	36 (26.3)	55 (40.1)	a	137 (100)	a	77 (56.6)	44 (32.4)	16 (11.8)
Chang et al.[27]	13	1 (7.7)	a	6 (46.2)	a	13 (100)	a	12 (92.3)	1 (7.7)	a
To et al.[28]	12	a	a	a	a	12 (100)	a	12 (100)	a	a
COVID-19 team[29]	15	a	a	a	a	15 (100)	a	11 (73.3)	a	a
Yueying et al.[30]	63	a	38 (60.3)	14 (22.2)	a	63 (100)	a	a	a	a
Li et al.[31]	24	a	a	a	a	24 (100)	a	a	a	a
Feng et al.[32]	21	18 (85.7)	a	a	a	21 (100)	a	21 (100)	a	a
Liang et al.[33]	1590	a	a	a	a	a	a	1590 (100)	a	a
Zhang et al.[34]	9	2 (2.22)	5 (55.6)	7 (77.8)	a	9 (100)	a	9 (100)	a	a
Feng et al.[35]	15	4 (26.7)	8 (53.3)	a	a	15 (100)	a	a	15 (100)	a
Wang et al.[17]	34	a	34 (100)	34 (100)	a	34 (100)	a	34 (100)	34 (100)	a
Xiaobo et al.[36]	52	a	a	a	35 (67.3)	a	a	52 (100)	a	32 (61.5)
Xia et al.[40]	20	6 (30)	10 (50)	12 (60)	a	a	a	20 (100)	a	a
Zhou et al.[37]	191	a	143 (75)	136 (71)	59 (31)	a	38 (20)	191 (100)	137 (71.7)	54 (28.3)
Wang et al.[39]	1	1 (100)	a	1 (100)	a	a	a	1 (100)	a	a
Qiu et al.[38]	36	a	a	19 (53)	a	a	0 (0)	36 (100)	a	a
Wan et al.[41]	135	a	135 (100.0)	a	21 (15.6)	a	1 (0.7)	120 (88.9)	15 (42.9)	1 (0.7)
Liu et al.[42]	56	16 (28.6)	40 (71.4)	a	a	a	3 (5.4)	a	53 (94.6)	3 (5.4)
Zhao et al.[43]	19	15 (44.1)	19 (55.9)	18 (52.9)	a	a	a	a	a	a
Zhou et al.[10]	62	10 (16.1)	52 (83.9)	25 (40.3)	a	a	a	a	a	a
Wang et al.[44]	69	a	a	a	a	a	a	44 (65.7)	18 (26.9)	5 (7.5)
Lei et al.[45]	20	2 (10.0)	18 (90.0)	16 (80.0)	1 (5.0)	a	1 (5.0)	6 (30.0)	14 (70.0)	0 (0.0)
Lei Pan et al.[46]	204	a	a	a	a	a	a	a	168 (82.35)	36 (17.65)
Fan et al.[47]	150	67 (44.67)	83 (55.33)	93 (62.00)	a	a	a	a	a	a
Richardson et al.[48]	5700	a	a	a	a	a	a	a	82 (13.5)	1381 (24.2)
Li et al.[49]	93	74 (80)	17 (18)	a	a	a	a	a	68 (73)	25 (27)
Hong et al.[50]	98	14 (14.3)	34 (34.7)	42 (42.9)	13 (13.3)		9 (9.1)	57 (58.2)	30 (30.6)	5 (5.1)
Garazzino et al.[51]	168	a	a	a	a	a	a	110 (65.1)	a	a
Zacharia et al.[52]	50	a	25 (69)	a	a	a	a	a	a	1 (2)
Matos et al.[53]	106	7 (6.6)	99 (93.4)	79 (74.5)	a	a	a	97 (91.5)	9 (8.5)	25 (23.6)
Li et al.[54]	102	a	a	a	a	a	a	2 (1.96)	85 (83.3)	15 (14.7)
Alsofyan et al.[55]	1519	a	a	a	a	a	a	1087 (71.6)	a	10 (0.65)

No, number.
a Data not available.

Table 6 Meta-Analysis outcomes for COVID-19 patients (random-effects model) (N = 35).

Item	No. of studies	Prevalence%	95% CI	n	I^2	T^2	P-value for testing heterogeneity.	Egger's test P
Demographical characteristics								
Age (mean in years)	21	46.8	41.0—52.6	20	99.78	180.467	<0.001	0.0438
Male	33	54.0	51.3—56.7	32	69.535	0.040	<0.001	0.0189
Co-Morbidities								
Co-morbidities	17	29.5	19.0—36.6	16	98.738	1.372	<0.001	0.8677
DM	17	13.8	8.7—21.1	17	96.645	1.076	<0.001	0.0183
Hypertension	15	11.7	5.7—22.6	14	98.66	2.241	<0.001	0.0025
CVD	16	9.7	6.5—14.2	15	92.455	9.639	<0.001	0.0441
COPD	14	3.9	2.9—5.3	13	62.282	0.132	<0.001	0.1004
Clinical manifestations								
Fever	31	82.0	67.7—90.8	30	98.557	4.531	<0.001	0.0117
Cough	29	54.3	45.5—62.9	28	93.792	0.779	<0.001	0.0090
Fatigue	21	30.2	23.3—38.1	20	83.651	0.465	<0.001	0.9873
Sputum	13	28.5	21.2—37.2	12	83.783	0.390	<0.001	0.7643
Sore Throat	10	21.7	14.6—31.0	9	74.296	0.338	<0.001	0.3871
Headache	13	11.0	7.9—15.2	12	68.412	0.227	<0.001	0.4517
Hemoptysis	3	5.3	3.0—8.9	2	0	0	0.424	0.1580
Laboratory findings								
Leukocytosis	16	7.5	4.5—12	15	85.716	0.842	<0.001	0.0093
Leukopenia	17	16.0	9.5—25.7	16	93.670	1.342	<0.001	0.2359
Lymphopenia	17	41.9	30.1—54.7	16	97.302	1.074	<0.001	0.0956
High Creatinine	7	7.7	3.2—17.3	6	86.947	1.135	<0.001	0.1139
High LDH	10	51.5	40.3—62.6	9	94.679	0.463	<0.001	0.0074
CRP	12	48.1	29.8—66.9	11	96.494	1.622	<0.001	0.0215
ESR	4	23.5	11.1—42.9	3	79.739	0.752	0.002	0.0214
Complications								
RNA Anemia	13	98.2	96.2—99.2	12	0	0	0.974	0.0001
Hospitalization	23	83.7	76.0—89.3	22	89.67	0.784	<0.001	0.0613
Bilateral Pneumonia	19	70.9	58.2—81.0	18	92.552	1.207	<0.001	0.0485
Unilateral Pneumonia	15	26.2	14.6—42.2	14	91.829	1.723	<0.001	0.2087
ARDS	6	23.6	12.9—39.2	5	91.623	0.703	<0.001	0.7139
Shock	7	8.5	4.4—10.8	6	74.476	0.516	<0.001	0.0254
Discharge	16	43.5	24.9—64.2	15	98.13	2.84	<0.001	0.8226
Death	17	10.5	6.8—16.1	16	94.32	0.816	<0.001	0.0214

No, number; CI, confidence interval; DM, diabetes mellitus; CVD, cardiovascular disease; COPD, chronic obstructive pulmonary disease ICU, intensive care unit. LDH, lactate dehydrogenase; ARDS, acute respiratory distress syndrome; CRP, C-reactive protein.
Q Cochran's Q statistic for heterogeneity. n, degree of freedom, I^2 Index for the degree of heterogeneity. T^2 Tau-squared measure of heterogeneity.

stages of the outbreak (17%) and reduced for patients with symptoms after first February (0.7%).[79]

Conclusion

Patients infected with the COVID-19 coronavirus had a wide clinical presentation with non-specific symptoms. With the major global outbreak of COVID-19, further research in the development of rapid diagnostic tests and an effective treatment are urgently needed.

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Approval was not required.

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