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Research Article

An Analytical Study of the Early COVID-19 Cases in Jordan

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A B S T R A C T

Background: The daily cases and fatalities in the COVID-19 pandemic are still on the rise. This study aimed to examine the epidemiological trends of the COVID-19 patients at an early stage in the pandemic.

Methods: This study included all COVID-19 positive patients who were admitted to the Prince Hamza Hospital between the 2nd and 31st of March 2020. The demographic, clinical, and laboratory data of the COVID-19 positive patients were reviewed and analysed.

Results: Of the 132 patients admitted during the period of study, 81 were males, with a mean age of 38.9 years (SD ± 19 yrs). Of those, 55 (41.7%) had comorbidities, 9% required oxygen supplementation, and 3 (2.2%) died. The most common clinical manifestations on admission were fever (36.4%), dry cough (17.4%), shortness of breath (12.9%), and anosmia (10.6%). CRP was elevated in 45.4%, and ESR was also high in 22.7% of patients with CRP elevation and was statistically significant in symptomatic patients (p = 0.004). Likewise, D-dimer was markedly elevated in 42.1% of the symptomatic patients (p = 0.025). Chest CT scans in symptomatic patients showed statistically significant bilateral lung infection (17.2%) as compared to non-symptomatic patients (p = 0.049).

Conclusion: The COVID-19 outbreak in Jordan at the beginning of the pandemic had presented clinically significant symptoms associated with higher values of CRP and CT chest findings.

Keywords: SARS-CoV-2, COVID-19, Jordan, RT-PCR, Prince Hamza Hospital

Introduction

In December 2019, a novel coronavirus was identified as the cause of a cluster of pneumonia cases in Wuhan, a city in the Hubei Province of China, and was later called SARS-CoV-2.[2] The virus was associated with progressive pneumonia, which is characterised by intravascular thrombosis resulting from loss of the endothelial barrier, loss of hypoxic vasoconstriction secondary to endothelial dysfunction,

and increased blood flow to collapsed lung tissue.[3] The most striking feature of this illness is its heterogeneity, ranging from subclinical infection to a serious illness.[4]

Initially, COVID-19 patients presented with flu-like illnesses commonly manifested as fever, dry cough, dyspnoea, headache, loss of smell, loss of taste, diarrhoea, and myalgia,[15-17] whereas patients in the second wave were younger and the duration of hospitalisation and case fatality rate were lower than those in the first wave.[20] In the second wave, there were more children and pregnant and post-partum women. The most frequent signs and symptoms in both waves were fever, dyspnoea, pneumonia, and cough, and the most relevant comorbidities were cardiovascular diseases, type 2 diabetes mellitus, and chronic neurological diseases.[21] Patients from the second wave more frequently presented renal and gastrointestinal symptoms, were more often treated with non-invasive mechanical ventilation and corticoids, and less often with invasive mechanical ventilation, conventional oxygen therapy and anticoagulants.[5]

A study led by Oxford University compared the symptoms between the Omicron and the Delta variants in England and found that sore throat was commonly reported in the Omicron virus cases and loss of smell and taste was less common among the Omicron cases compared to the Delta variant cases.[22] The Omicron variant is at least twice as contagious as Delta and at least four times as contagious as the original version of the coronavirus.[23]

On March 2, 2020, Jordan reported the first case of COVID-19. The progress of the pandemic during 2020 in Jordan is summarised in Figure 1.

Despite the "wax and wane" in the Jordanian battle against the virus, another successive three waves have hit Jordan peaking around March, December 2021, and February 2022 respectively. The morbidity and mortality during the second and third waves were on the rise again. Despite recording the highest infection numbers during the fourth wave (caused by the Omicron variant), it did not pose any significant burden on the healthcare institutions in Jordan.

In this study, we aim to describe the epidemiological, clinical, laboratory, and radiological findings of 132 hospitalised COVID-19 patients from Prince Hamza teaching Hospital in Jordan who were admitted between 17 and 31 March 2020.

On one hand, this study would provide a theoretical basis for epidemiological features, clinical outcomes, and diagnostic criteria among Jordanian COVID-19 patients, and on the other hand, it could be advantageous and would help in understanding the early phase of the pandemic and provide an insight into the disease progression and help in the development of containment strategies.

Materials and Method

Study Participants

This retrospective study included 132 patients (males and females) aged between 2 and 85 years, who tested positive for SARS-CoV-2 during the first wave and were admitted to Prince Hamza teaching Hospital in Amman, Jordan from March 2020 to April 2020. Only the patients who tested positive after their death were excluded. This study approved by The Hashemite University and Prince Hamza Hospital IRB committees. Data were collected from the hospital's medical records, and no informed consent was required.

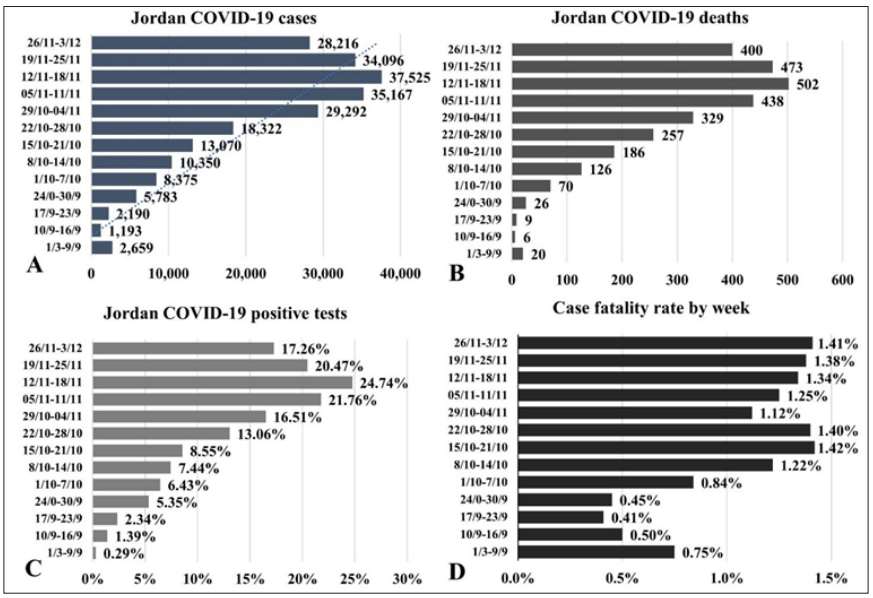

Figure 1.A Weekly Update of the Progression of COVID-19 Pandemic in Jordan through 2020. (A). Weekly New Numbers of Laboratory-confirmed COVID-19 Cases. (B). Weekly Numbers of Deceased COVID-19 Patients. (C). Increasing Percentage of Positive COVID-19 Tests Week by Week. (D). Weekly Case Fatality Rate

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Data Collection

The epidemiological, clinical, and laboratory data were retrieved from the hospital's electronic medical records. Laboratory investigations that were carried out included complete blood count, coagulation profile, C-reactive protein (CRP), D-dimer, liver function, kidney function, and erythrocyte sedimentation rate (ESR).

Laboratory Procedures

All patients were confirmed positive for SARS-CoV-2 infection in nasopharyngeal swabs analysed by RT-PCR. Routine blood work included complete blood count, serum biochemical tests (kidney function, liver function, electrolytes, and creatine kinase), serum ferritin, and myocardial enzymes.

Statistical Analysis

The statistical analysis was performed using the statistical package for social science IBM SPSS version 21. Data were expressed as mean ± standard deviation (SD), different group comparisons and significant differences were performed using the Wilcoxon signed-rank test. The Chi-square test was used to analyse the numerical and categorical data differences between groups. Correlation and strength of association between two variables were measured using the Spearman correlation analysis. A p value less than 0.05 was considered statistically significant.

Results

This retrospective study enrolled 132 confirmed COVID-19 patients who were admitted to Prince Hamza Hospital in Amman, Jordan. In this study, the majority of the cases were males (81/ 132, 61.4%) with a mean age of 38.89 years (SD 19.04). Most infections were seen among patients aged < 60 years (85.6%), whereas patients aged 1-20 years represented 19.7% of the diagnosed cases. Patients aged 21-40 years, 41-60 years, and older than 60 years represented 31.1%, 34.85%, and 14.4% respectively (Figure 2). Almost one-third of patients have reported a history of travel from COVID-19 endemic countries in the preceding 4 weeks to admission, while most patients have reported previous close contact with a COVID-19 positive person. Only 3 patients were healthcare workers and 28 were smokers. Chronic illnesses such as diabetes, hypertension, cardiovascular disease, and asthma were reported in a third of the cases (Table 1). While only 11 patients reported taking the influenza virus vaccine during the wintertime, most patients reported taking the BCG vaccine. The demographic and clinical data of the patients are detailed in Table 1.

COVID-19 patients were admitted to the hospital regardless of whether they were symptomatic or asymptomatic and they all underwent full investigative procedures. Fifty-one per cent (n = 68) of the quarantined patients were symptomatic, while the remaining had no symptoms. The most remarkable symptoms observed were fever (36.4%), dry cough (17.4%), shortness of breath (12.9%), and loss of smell and taste (10.6%, 9.1%). Less common symptoms included fatigue (7.6%), productive cough (7.6%), headache (6.8%), sore throat (3.8%), chest pain (3.8%), vomiting (3.8%), and other minor symptoms as shown in Table 2. Three patients developed severe pneumonia and required admission to the intensive care unit and mechanical ventilation.

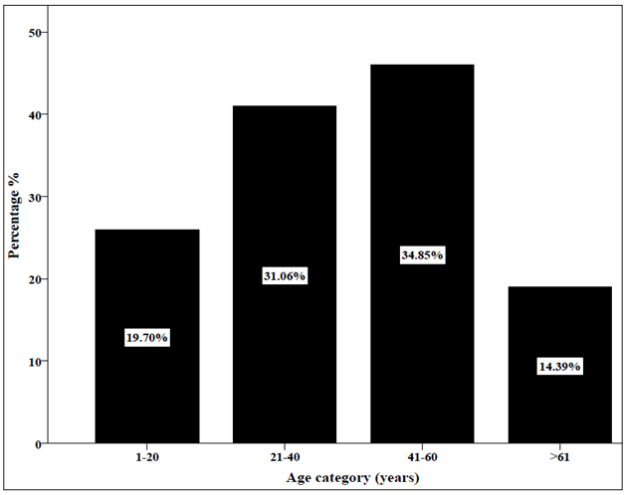

Figure 2.Distribution of PCR Confirmed COVID-19 Patients by Age Group

Table 1.Demographic Data and Medical History of Hospitalised COVID-19 Patients

N = 132

Variables	N = 132 (%)
Age (mean ± SD)	38.89 ± 19.04
Male gender	81 (61.4%)
History of travel from COVID-19 endemic country within 28 days	38 (28.8%)
History of contact with COVID-19 positive case	122 (92.4%)
Healthcare worker	3 (2.3%)
Smoking	28 (21.2%)
Clinical illnesses	46 (34.8%)
Diabetes mellitus	20 (15.2%)
Hypertension	22 (16.7%)
Cardiovascular disease	9 (6.8%)
Asthma	4 (3.0%)
BCG vaccination	125 (94.7%)
Influenza vaccination season 2019/ 2020	11 (8.3%)

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Table 2.Frequency of Symptoms among Patients with Confirmed COVID-19

	n	%
Asymptomatic	68	51.50
Symptomatic	64	48.50
Fever	48	36.40
Sore throat	5	3.80
Loss of smell	14	10.60
Loss of taste	12	9.10
Swallowing difficulty	2	1.50
Runny nose	3	2.30
Headache	9	6.80
Chest pain	5	3.80
Shortness of breath	17	12.90
Dry	23	17.40
Cough	33	25.0
Productive	10	7.60
Fatigue	10	7.60
Loss of appetite	4	3.0
Diarrhoea	4	3.0
Vomiting	5	3.80
Abdominal pain	1	0.80
Joint pain	2	1.50

Regarding hospital quarantine duration, the mean duration was 18.6 days. 43% of the patients were quarantined for 14 days and then discharged as they became COVID-19 negative. Longer hospitalisation durations were reported in other patients and varied between 3-4 weeks (45%), 4-6 weeks (10%), and longer than 6 weeks (2.2%). The relation between duration of hospital admission and multiple variables (age of the patient, sex, smoking, presence of specific health problems such as hypertension, diabetes, and asthma, taking BCG vaccine and influenza virus vaccine) were tested to find if there was a significant correlation. No significant correlation was found between the duration of hospital quarantine and the other previously mentioned variables ($p > 0.05$).

As part of their therapeutic plan, patients underwent a wide array of laboratory investigations at the time of admission such as C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), WBC, haemoglobin level, basophils, monocytes, eosinophils, platelets, neutrophils, ALT, AST, total bilirubin, direct bilirubin, D-dimer, Cl, Na, Ca, K, ferritin, albumin, urea, creatinine, CPK, ALP, LDH, and PT. The mean admission values of symptomatic and asymptomatic patients are shown in Table 3. Acute phase reactants such as CRP and ESR were markedly elevated in COVID-19 symptomatic patients, whereas other laboratory values were nearly equal among symptomatic and asymptomatic patients. All values of the laboratory workup for the COVID-19-positive patients are shown in Table 3.

Table 3.Admission Values of Laboratory Investigations in COVID-19 Patients

Diagnostic Parameters	Symptoms		P value
	Asymptomatic	Symptomatic	
	Mean	Mean	
C reactive protein(mg/l)	13.48	40.87	0.004
ESR (mm/h)	28.3	40.7	0.458
Hgb (g/dl)	14.26	13.61	0.292
WBC (103/mm3)	7.9	6.78	0.508
Neutrophils %	57.6	66.2	0.421
Lymphocytes %	35.74	30.56	0.036
Eosinophils %	0.5	0.9	0.558
Monocytes %	12	14.4	0.431
Basophils %	0.03	0.02	0.371
Platelet count (103/mm3)	249.4	237.9	0.215
ALT (u/l)	27.2	31	0.341
AST (u/l)	27	33.9	0.151
Total Bilirubin	13.19	10.63	0.485
Direct Bilirubin (µmol/l)	3.37	3.56	0.403
D-dimer (µg/ml)	0.63	0.56	0.332
CL (mmol/l)	105.1	105.3	0.881
Na (mmol/l)	139	138.8	0.068
Ca (mg/dl)	14.96	13.62	0.444
K (mmol/l)	4.25	4.16	0.486
Ferritin (ng/ml)	189.38	350.35	0.446
Albumin (g/dl)	4.04	4.03	0.428
Urea (mmol/l)	4.72	6.2	0.169

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Creatinine (µmol/l)	70.53	85.1	0.544
CPK (u/l)	87.31	171.87	0.232
Blood sugar	158.8	188.7	0.445
ALP (u/l)	76.2	66.6	0.301
LDH (u/l)	203.3	256.8	0.481
PT seconds	13.97	14.14	0.525
O2 saturation room air	94.60%	94.40%	0.865
PH room air	.	7.5	NA
PaCO2 room air	.	33.4	NA
PaO2 room air	.	66	NA
HCO3 room air	.	26.7	NA

In symptomatic patients, radiology findings played an important role in the therapeutic plans. In the studied sample, the CT scan findings were as follows: normal in 28% of the patients, abnormal with ground-glass opacities and consolidations in 31% of the patients, minor infiltrates were seen in 11% of the patients, and the remaining 28% did not require radiological investigation. Among patients with abnormal chest CT, 26 patients showed unilateral lung involvement (13 symptomatic and 13 asymptomatic patients), while bilateral lung lesions were seen in 3 asymptomatic and 11 symptomatic patients. The use of oxygen therapy to alleviate shortness of breath associated with lung infection is proven effective in many COVID-19 patients during recovery. Twelve patients in this study required oxygen therapy in the form of nasal canula or mask representing 9% of the patients. Only 3 patients required more aggressive oxygen therapy and were placed on mechanical ventilation.

Fifty per cent of the symptomatic patients were admitted to the hospital for more than 2 weeks compared to 26.5% of the asymptomatic patients (p = 0.005). Also, symptomatic patients were found to have higher CRP and D-dimer values (p = 0.004, and p = 0.025 respectively). Chest CT scan showed bilateral lesions in 17.2% of symptomatic patients compared with only 4.4% of asymptomatic patients (p = 0.049). No significant differences between symptomatic and asymptomatic patients were seen in age, gender, smoking habit, chronic illnesses, BCG and flu vaccine, WBC count, and ESR values (Table 4).

All admitted asymptomatic COVID-19 patients (51.5%) at Prince Hamza Hospital were discharged after having two consecutive negative PCR tests with minimal medical intervention. On the other hand, symptomatic patients were also admitted and treated according to the following protocol: paracetamol injection 1000 mg (PRN), azithromycin 500 mg once daily, hydroxychloroquine 200 mg/12 hours, dexamethasone injection 1 mg/12 hours, and anticoagulant (LMWH) 40-60 mg/day. Patients were also given the following supplements: zinc sulfate 1 tab/day, vitamin B-complex 1 tab/day, and ascorbic acid 1000 mg/day. All symptomatic patients were discharged after the disappearance of their symptoms and reported two consecutive negative PCR tests. Three patients aged 63, 69, and 84 years of the 132 (2.3%) died during hospitalisation as their medical condition deteriorated and they developed acute respiratory distress syndrome (ARDS). The patients in their sixties were males and they had hypertension while the 84-year-old patient was a female with cardiac disease.

Table 4.Comparison of Demographic, Laboratory, and Radiographic Findings among COVID-19 Patients

	Asymptomatic (n = 68)	**Symptomatic (n = 64)**	**P value**
Age (mean ± SD)	36.07 ± 17.43	41.89 ± 20.32	0.265
Male gender	42 (61.8%)	39 (60.9%)	0.922
Smoking	14 (20.6%)	14 (21.9%)	0.982
Comorbid illnesses	24 (35.3%)	31 (48.4%)	0.126
BCG vaccination	66 (97.1%)	59 (92.2%)	0.212
Flu vaccination	5 (7.4%)	6 (9.4%)	0.674
Hospital stay (> 2 weeks)	18 (26.5%)	32 (50.0%)	0.005
C reactive protein (> 5 mg/l)	22 (37.3%)	38 (63.3%)	0.004
WBC (< $4x10^3$/ mm^3)	5 (7.6%)	3 (4.8%)	0.508
D-dimer (> 0.5 µg/ml)	9 (19.6%)	16 (42.1%)	0.025
ESR (> 20 mm/h)	14 (53.8%)	16 (61.5%)	0.575
Chest CT scan (bilateral injury)	3 (4.4%)	11 (17.2%)	0.049

Discussion

This is the second clinical and epidemiological study in Jordan that describes the demographic data, clinical features, laboratory, and radiological findings of the

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COVID-19 patients. Men were affected more frequently than women and most patients were younger than 60 years old. Almost half of the COVID-19 patients were symptomatic, with fever being the most common symptom. Extended hospital stays, elevated inflammatory markers, and bilateral lung involvement were common among symptomatic patients. Ultimately, 3 patients died due to progressive respiratory failure.

In this study, most COVID-19 patients were relatively young and only 14.4% of the patients were aged over 60 years which is in coherence with the findings of other epidemiological reports from the Middle East,[29-31] and contrary to what was reported in China.[32] Men were more susceptible to infection with SARS-CoV-2 than women, and they represented 61% of the symptomatic population in our study consistent with the findings reported elsewhere.[33,34]

Symptomatic patients in our study presented mostly with mild symptoms. Fever was the most common presenting symptom followed by dry cough and shortness of breath. Likewise, studies in Oman and Singapore had reported similar findings.[29,35] Among those only 9% required oxygen therapy to improve their oxygen saturation levels and alleviate their shortness of breath. A study by Mohan et al. has shown that only 3.5% of their patients required oxygen therapy while 27.8% of the patients in New York required oxygen supplementation.[36,37] Three out of the 12 patients who required oxygen therapy progressed to ARDS and unfortunately died in our study.

Regarding the laboratory findings, symptomatic patients have shown elevated CRP and ESR values, but CRP elevation was significantly higher than ESR unlike the findings reported by Samrah et al.[28] Although numerous studies have shown multiple fold elevation of D-dimer in COVID-19 patients, our study has shown that only 20% of the patients had D-dimer values in excess of 0.5 µg/ml, and the D-dimer values were significantly higher in critically ill patients.[38]

It is not uncommon to have normal radiological findings in COVID-19 patients especially in those with mild illness or at the early phase of the infection.[39] In this study, 30% of the patients had chest infiltrates, most were unilateral, and they were equally seen in symptomatic and asymptomatic patients (n = 13 each). Bilateral chest infiltrates were significantly seen in symptomatic patients, and they played a role in the severity of the infection and patients opted for the use of oxygen supplementation. Smoking was reported equally in symptomatic and asymptomatic patients and did not seem to have affected or aggravated the SARS-CoV-2 infection. Additionally, comorbid illnesses such as diabetes, hypertension, and heart problems were seen more frequently in symptomatic patients but without statistical significance (p = 0.126).

COVID-19 severity varied worldwide with countries like Singapore, Australia, and Hong Kong reporting mild illnesses, while countries like Italy, Spain, and USA recording more severe cases. Likewise, the case fatality rate (CFR) reported worldwide varied due to multiple factors like the age distribution of the population in different countries, the constantly evolving understanding of the disease, and the introduction of new therapeutic strategies to the recent treatment protocols of the COVID-19 patients. The CFR in this study was 2.2%, which was close to the Jordanian national CFR as of April 1 of 1.8% (5/274) and lower than the global CFR of 4.9% (40,598/823,626). This could be attributed to the lockdown measures imposed by the Jordanian government which limited the number of infections, and the young age of the patients included in this study as the mean age was 38.9 years.[40] The CFR in Jordan as of late November 2020 is 1.2% (2,509/203,021) compared to the global CFR of 2.3%.[41]

Countries in Europe have reported high CFR figures at certain points during the pandemic and at that time it was thought that the administration of BCG as part of the national vaccination programme in the Middle Eastern countries might have boosted the immune system and prevented the spread of the infection and development of severe and critical COVID-19 cases.[42,43] It was also suggested that trained immunity induced by BCG and other live attenuated vaccines might have been protective,[44] but as of now and after almost 1 year of the first reported case of COVID-19, we have seen that the pandemic has spread globally and the only effective reported measures were lockdowns and curfews and implementation of strict face mask wearing, social distancing, and self-hygiene.[45] Our experience in Jordan is a good example of how easing the restriction measures and allowing people to get back to their near-normal daily activities with little compliance with the recommendations of the health authorities has led to a surge in COVID-19 cases and fatalities (Figure 1).

These strict measures were proven effective at an early stage during the pandemic in Jordan, but they were associated with unfavourable and tough economic consequences, especially in a country with limited resources like Jordan, but this model has proved to be effective in China at the beginning of the pandemic and in Victoria, Australia on two occasions where they were able to mitigate the spread of the virus, especially after the second wave during the winter.[46]

Our study has numerous noteworthy limitations. First, the sample size included in this study is small. Second, the cohort included both symptomatic and asymptomatic COVID-19 patients because the protocol at the beginning of the pandemic in Jordan called for the admission of all confirmed positive cases. Finally, documentation was

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incomplete and lacked some laboratory and radiological findings. Despite these limitations, this study is informative since it was carried out in Prince Hamza Hospital which was at that time the first and only hospital for COVID-19 patients. The findings in this study could set a baseline finding that might be compared with more recent and larger cohort studies to draw out epidemiological changes throughout the path of the pandemic in Jordan and the region.

Conclusion

Most COVID-19 patients were aged between 20 and 60 years which could be attributed to the fact that the population here is younger compared to the developed world populations. Also, in this study, males were more frequently infected with SARS-CoV-2. Half of the patients were asymptomatic. Among the symptomatic group, fever, dry cough, and SOB were the most evident symptoms. CRP inflammatory marker was a good indicator of the illness severity. Bilateral chest infection was associated with case severity and with the need of oxygen therapy. Infection among the Jordanian patients in the early days of the pandemic was more on the mild to moderate side compared to other countries but the second peak was surlier. This could be attributed to the less strict containment measures imposed and practised later on due to the emerging economical strains.

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Ethical Clearance

The Research Ethical Committee at scientific research granted ethical approval for the study.

Funding: None

Conflict of Interest: None

References

1. Vilcek S. SARS-CoV-2: zoonotic origin of pandemic coronavirus. Acta Virol. 2020;64(3):281-7. [PubMed] [Google Scholar]
2. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R, Niu P, Zhan F, Ma X, Wang D, Xu W, Wu G, Gao GF, Tan W; China Novel Coronavirus Investigating and Research Team. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020;382(8):727-33. [PubMed] [Google Scholar]
3. Habashi NM, Camporota L, Gatto LA, Nieman G. Functional pathophysiology of SARS-CoV-2-induced acute lung injury and clinical implications. J Appl Physiol [Internet]. 2021 Mar 1 [cited 2022 Mar 8];130(3):877-91. Available from: https://pubmed.ncbi.nlm.nih.gov/33444117/ [PubMed] [Google Scholar]
4. Grasselli G, Zangrillo A, Zanella A, Antonelli M, Cabrini L, Castelli A, Cereda D, Coluccello A, Foti G, Fumagalli R, Iotti G, Latronico N, Lorini L, Merler S, Natalini G, Piatti A, Ranieri MV, Scandroglio AM, Storti E, Cecconi M, Pesenti A; COVID-19 Lombardy ICU Network. Baseline characteristics and outcomes of 1591 patients infected with SARS-CoV-2 admitted to ICUs of the Lombardy Region, Italy. JAMA [Internet]. 2020 Apr 28 [cited 2022 Mar 8];323(16):1574. Available from: https://pubmed.ncbi.nlm.nih.gov/32250385/ [PubMed] [Google Scholar]
5. World Health Organization. Situation Report-12 situation in numbers total and new cases in last 24 hours. 2020.
6. Fagbule OF. 2019 Novel Coronavirus. Ann Ib Postgrad Med. 2019 Dec;17(2):108-10. [PubMed] [Google Scholar]
7. Bevova MR, Netesov SV, Aulchenko YS. The new Coronavirus COVID-19 infection. Mol Gen Microbiol Virol. 2020;35(2):53-60. [PubMed] [Google Scholar]
8. Zaim S, Chong JH, Sankaranarayanan V, Harky A. COVID-19 and multiorgan response. Curr Prob Cardiol. 2020;45(8):100618. [PubMed] [Google Scholar]
9. Das G, Mukherjee N, Ghosh S. Neurological insights of COVID-19 pandemic. ACS Chem Neurosci. 2020;11(9):1206-9. [PubMed] [Google Scholar]
10. Ye ZW, Yuan S, Yuen KS, Fung SY, Chan CP, Jin DY. Zoonotic origins of human coronaviruses. Int J Biol Sci. 2020;16(10):1686-97. [PubMed] [Google Scholar]
11. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, Si HR, Zhu Y, Li B, Huang CL, Chen HD, Chen J, Luo Y, Guo H, Jiang RD, Liu MQ, Chen Y, Shen XR, Wang X, Zheng XS, Zhao K, Chen QJ, Deng F, Liu LL, Yan B, Zhan FX, Wang YY, Xiao GF, Shi ZL. A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature. 2020 Mar 12;579(7798):270-3. [PubMed] [Google Scholar]
12. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, Ren R, Leung KS, Lau EH, Wong JY, Xing X, Xiang N, Wu Y, Li C, Chen Q, Li D, Liu T, Zhao J, Liu M, Tu W, Chen C, Jin L, Yang R, Wang Q, Zhou S, Wang R, Liu H, Luo Y, Liu Y, Shao G, Li H, Tao Z, Yang Y, Deng Z, Liu B, Ma Z, Zhang Y, Shi G, Lam TT, Wu JT, Gao GF, Cowling BJ, Yang B, Leung GM, Feng Z. Early transmission dynamics in Wuhan, China, of Novel Coronavirus–infected pneumonia. N Engl J Med. 2020; 382(13):1199-207. [PubMed] [Google Scholar]
13. Centers for Disease Control and Prevention [Internet]. COVIDView: a weekly surveillance summary of U.S.; 2020 [cited 2020 Dec 5]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html
14. Yanes-Lane M, Winters N, Fregonese F, Bastos M, Perlman-Arrow S, Campbell JR, Menzies D. Proportion of asymptomatic infection among COVID-19 positive persons and their transmission potential: a systematic

review and meta-analysis. PLoS One. 2020 Nov 1;15(11):e0241536. [PubMed] [Google Scholar]
15. Ren LL, Wang YM, Wu ZQ, Xiang ZC, Guo L, Xu T, Jiang YZ, Xiong Y, Li YJ, Li XW, Li H, Fan GH, Gu XY, Xiao Y, Gao H, Xu JY, Yang F, Wang XM, Wu C, Chen L, Liu YW, Liu B, Yang J, Wang XR, Dong J, Li L, Huang CL, Zhao JP, Hu Y, Cheng ZS, Liu LL, Qian ZH, Qin C, Jin Q, Cao B, Wang JW. Identification of a novel coronavirus causing severe pneumonia in human: a descriptive study. Chin Med J (Engl). 2020 May 5;133(9):1015-24. [PubMed] [Google Scholar]
16. Wang W, Tang J, Wei F. Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China. J Med Virol. 2020 Apr;92(4):441-7. [PubMed] [Google Scholar]
17. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, Yu T, Xia J, Wei Y, Wu W, Xie X, Yin W, Li H, Liu M, Xiao Y, Gao H, Guo L, Xie J, Wang G, Jiang R, Gao Z, Jin Q, Wang J, Cao B. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506. [PubMed] [Google Scholar]
18. Lei J, Li J, Li X, Qi X. CT imaging of the 2019 novel coronavirus (2019-NCoV) pneumonia. Radiology. 2020;295(1):18. [PubMed] [Google Scholar]
19. Haigh K, Syrimi ZJ, Irvine S, Blanchard TJ, Pervaiz MS, Toth AG, Ratcliffe L. Hyperinflammation with COVID-19: the key to patient deterioration? Clin Infect Pract. 2020 Oct;7:100033. [PubMed] [Google Scholar]
20. Al Bahrani S, Al Ahmadi N, Hamdan S, Elsheikh N, Osman A, Almuthen S, Almajed GN, Alkhuraim AH, Jebakumar AZ, Al-Tawfiq JA. Clinical presentation and outcome of hospitalized patients with COVID-19 in the first and second waves in Saudi Arabia. Int J Infect Dis [Internet]. 2022 [cited 2022 Mar 8];118:104-8. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1201971222001278 [PubMed] [Google Scholar]
21. Iftimie S, Lopez-Azcona AF, Vallverdu I, Hernandez-Flix S, de Febrer G, Parra S, Hernández-Aguilera A, Riu F, Joven J, Andreychuk N, Baiges-Gaya G, Ballester F, Benavent M, Burdeos J, Català A, Castañé E, Castañé H, Colom J, Feliu M, Gabaldó X, Garrido D, Garrido P, Gil J, Guelbenzu P, Lozano C, Marimon F, Pardo P, Pujol I, Rabassa A, Revuelta L, Ríos M, Rius-Gordillo N, Rodríguez-Tomàs E, Rojewski W, Roquer-Fanlo E, Sabaté N, Teixidó A, Vasco C, Camps J, Castro A. First and second waves of coronavirus disease-19: a comparative study in hospitalized patients in Reus, Spain. PLoS One [Internet]. 2021 Mar 1 [cited 2022 Mar 8];16(3):e0248029. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8011765/ [PubMed] [Google Scholar]
22. Fox 13 [Internet]. Omicron vs. delta: study examines difference between two coronavirus variant symptoms; 2022 [cited 2022 Mar 8]. Available from: https://www.q13fox.com/news/omicron-delta-study-coronavirus-variant-symptoms
23. Islam S, Islam T, Islam MR. New Coronavirus variants are creating more challenges to global healthcare system: a brief report on the current knowledge. Clin Pathol [Internet]. 2022 [cited 2022 Mar 8];15:2632010X221075584. Available from: https://pubmed.ncbi.nlm.nih.gov/35141522/ [PubMed] [Google Scholar]
24. World Health Organization. Coronavirus disease 2019 (COVID-19) Situation Report - 57. 2020.
25. Khatatbeh M. Efficacy of nationwide curfew to encounter spread of COVID-19: a case from Jordan. Front Public Health. 2020;8:394. [PubMed] [Google Scholar]
26. World Health Organization [Internet]. Weekly epidemiological update - 24 November 2020; 2020 [cited 2020 Nov 27]. Available from: https://www.who.int/publications/m/item/weekly-epidemiological-update---24-november-2020
27. World Health Organization [Internet]. Weekly epidemiological update - 7 September 2020; 2020 [cited 2020 Nov 27]. Available from: https://www.who.int/publications/m/item/weekly-epidemiological-update---7-september-2020
28. Samrah SM, Al-Mistarehi AH, Ibnian AM, Raffee LA, Momany SM, Al-Ali M, Hayajneh WA, Yusef DH, Awad SM, Khassawneh BY. COVID-19 outbreak in Jordan: epidemiological features, clinical characteristics, and laboratory findings. Ann Med Surg (London). 2020;57:103-8. [PubMed] [Google Scholar]
29. Khamis F, Al-Zakwani I, Al Naamani H, Al Lawati S, Pandak N, Omar MB, Al Bahrani M, Al Bulushi Z, Al Khalili H, Al Salmi I, Al Ismaili R, Al Awaidy ST. Clinical characteristics and outcomes of the first 63 adult patients hospitalized with COVID-19: an experience from Oman. J Infect Public Health. 2020 Jul;13(7):906-13. [PubMed] [Google Scholar]
30. Nikpouraghdam M, Farahani AJ, Alishiri GH, Heydari S, Ebrahimnia M, Samadinia H, Sepandi M, Jafari NJ, Izadi M, Qazvini A, Dorostkar R, Tat M, Shahriary A, Farnoosh G, Zijoud SR, Taghdir M, Alimohamadi Y, Abbaszadeh S, Ghaleh HE, Bagheri M. Epidemiological characteristics of coronavirus disease 2019 (COVID-19) patients in Iran: a single center study. J Clin Virol. 2020 Jun 1;127:104378. [PubMed] [Google Scholar]
31. Al Mutair A, Alhumaid S, Alhuqbani WN, Zaidi AR, Alkoraisi S, Al-Subaie MF, AlHindi AM, Abogosh AK, Alrasheed AK, Alsharafi AA, Alhuqbani MN, Alhowar NA, Salih S, Alhedaithy MA, Al-Tawfiq JA, Al-Shammari H, Abdulqawi R, Ismail AF, Hamdan N,

ISSN: 0019-5138
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Saad F, Olhaye FA, Eltahir TA, Rabaan AA, Al-Omari A. Clinical, epidemiological, and laboratory characteristics of mild-to-moderate COVID-19 patients in Saudi Arabia: an observational cohort study. Eur J Med Res. 2020;25(1):61. [PubMed] [Google Scholar]

32. Wang F, Cao J, Yu Y, Ding J, Eshak ES, Liu K, Mubarik S, Shi f, Wen H, Zeng Z, Bai J, Yu C. Epidemiological characteristics of patients with severe COVID-19 infection in Wuhan, China: evidence from a retrospective observational study. Int J Epidemiol. 2021 Jan;49(6):1940-50. [PubMed] [Google Scholar]
33. Liu H, Gao J, Wang Y, Jie J, Luo J, Xu Y, Sun H, Song L, Li D, Peng L, Hua S. Epidemiological and clinical characteristics of 2019 novel coronavirus disease (COVID-19) in Jilin, China: a descriptive study. Medicine (Baltimore). 2020 Nov;99(47):e23407. [PubMed] [Google Scholar]
34. Livingston E, Bucher K. Coronavirus Disease 2019 (COVID-19) in Italy. JAMA. 2020;323(14):1335. [PubMed] [Google Scholar]
35. Young BE, Ong SW, Kalimuddin S, Low JG, Tan SY, Loh J, Ng OT, Marimuthu K, Ang LW, Mak TM, Lau SK, Anderson DE, Chan KS, Tan TY, Ng TY, Cui L, Said Z, Kurupatham L, Chen MI, Chan M, Vasoo S, Wang LF, Tan BH, Lin RT, Lee VJ, Leo YS, Lye DC; Singapore 2019 Novel Coronavirus Outbreak Research Team. Epidemiologic features and clinical course of patients infected with SARS-CoV-2 in Singapore. JAMA. 2020;323(15):1488-94. [PubMed] [Google Scholar]
36. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW; the Northwell COVID-19 Research Consortium; Barnaby DP, Becker LB, Chelico JD, Cohen SL, Cookingham J, Coppa K, Diefenbach MA, Dominello AJ, Duer-Hefele J, Falzon L, Gitlin J, Hajizadeh N, Harvin TG, Hirschwerk DA, Kim EJ, Kozel ZM, Marrast LM, Mogavero JN, Osorio GA, Qiu M, Zanos TP. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. JAMA. 2020 May;323(20):2052-9. [PubMed] [Google Scholar]
37. Mohan A, Tiwari P, Bhatnagar S, Patel A, Maurya A, Dar L, Pahuja S, Garg R, Gupta N, Sahoo B, Gupta R, Meena VP, Vig S, Pandit A, Mittal S, Madan K, Hadda V, Dwivedi T, Choudhary A, Brijwal M, Soneja M, Guleria R, Ratre B, Kumar B, Bhopale S, Panda S, Singh AR, Singh S, Wundavalli L. Clinico-demographic profile & hospital outcomes of COVID-19 patients admitted at a tertiary care centre in north India. Indian J Med Res. 2020 Jul;152(1&2):61-9. [PubMed] [Google Scholar]
38. Tang N, Li D, Wang X, Sun Z. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. J Thromb Haemost. 2020;18(4):844-7. [PubMed] [Google Scholar]
39. Wong HY, Lam HY, Fong AH, Leung ST, Chin TW, Lo CS, Mei-Sze Lui M, Lee JC, Wan-Hang Chiu K, Wai-Hin Chung T, Lee EY, Wan EY, Hung IF, Lam TP, Kuo MD, Ng MY. Frequency and distribution of chest radiographic findings in patients positive for COVID-19. Radiology. 2020 Aug;296(2):E72-8. [PubMed] [Google Scholar]
40. World Health Organization. Coronavirus disease 2019 (COVID-19) Situation Report-72 Highlights. 2020.
41. Worldometers [Internet]. Coronavirus Update (Live): 61,908,045 Cases and 1,447,158 Deaths from COVID-19 Virus Pandemic - Worldometer; 2020 [cited 2020 Nov 28]. Available from: https://www.worldometers.info/coronavirus/
42. Malik YS, Ansari MI, Ganesh B, Sircar S, Bhat S, Pande T, Vinodhkumar OR, Kumar P, Yatoo MI, Tiwari R, Touil N, Patel SK, Pathak M, Sharun K, Dhama K. BCG vaccine: a hope to control COVID-19 pandemic amid crisis. Hum Vaccin Immunother. 2020;16(12):2954-62. [PubMed] [Google Scholar]
43. Kinoshita M, Tanaka M. Impact of routine infant BCG vaccination on COVID-19. J Infect. 2020 Oct;81(4):625-33. [PubMed] [Google Scholar]
44. Alsulaiman JW, Khasawneh AI, Kheirallah KA. Could "trained immunity" be induced by live attenuated vaccines protect against COVID-19? Review of available evidence. J Infect Dev Ctries. 2020;14(9):957-62. [PubMed] [Google Scholar]
45. Hensel J, McAndrews KM, McGrail DJ, Dowlatshahi DP, LeBleu VS, Kalluri R. Protection against SARS-CoV-2 by BCG vaccination is not supported by epidemiological analyses. Sci Rep. 2020;10(1):18377. [PubMed] [Google Scholar]
46. Australian Government. COVID-19 Australia: Epidemiology Report 29. 2020.

ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202252