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# The Factors Associated with Variation in Length of Hospital Stay in Covid19 Patients

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## ABSTRACT

**Background:** The COVID-19 pandemic has significantly burdened healthcare and economic infrastructures. Identifying indicators linked to hospitalization requirements and duration of stay (LOS) could be crucial for efficiently allocating resources and prioritizing patient care.

**Objectives:** The purpose of this study was to investigate, retrospectively, the variables influencing the length of hospital stay (LoS) for patients with COVID-19.

**Patients and Methods:** This study included 300 patients with Covid 19 who were admitted to the 23 July Chest Hospital, El Marg Qaluobia Government, during the period from october 2020 to September 2022. Patients were divided according to length of hospital stay into 2 groups; **Not prolonged group;** included 170 patients (56.7%) with LoS < 11 days, and **Prolonged group;** included 130 patients (43.3%) with LOS > 11 days. Patients were subjected to complete history taking and physical examination. Complete blood count (CBC), C- reactive protein, D-dimer, liver function tests, kidney function tests, radiological examinations and Naso-pharyngeal swab were done.

**Results:** prolonged group were statistically older (61±11 years) than not prolonged group (48±13 years), p <0.001. Also, comorbidities and smoking were common in prolonged than the other group. Anemia, leucopenia, lymphopenia, thrombocytopenia were more common in prolonged group than the other group. Also, all cases in prolonged group showed elevated d-dimer, CRP, higher frequencies of bilateral pulmonary infiltration and consolidation compared with not prolonged group.

**Conclusion:** Old age, comorbidities and smoking are associated with prolonged hospital stay. In addition, O2 saturation < 86%, high levels of blood glucose, D dimer, CRP are significant independent predictors of prolonged hospital stay.

**Keywords:** Length Of Hospital Stay; LOS: Covid19

## INTRODUCTION

A new coronavirus, emerging in December 2019 and named SARSCoV2, triggered a global outbreak of a respiratory illness known as COVID [(1)]. The World Health Organization declared COVID-19 a worldwide public health crisis on January 30, 2020 [(2)].

Beyond causing death and illness, COVID-19 intensifies economic and societal burdens, leading to lasting and escalating consequences [(3)]. Treating patients with proven disease requires many physicians, nurses, and hospital beds, which has an impact on the global healthcare system by taxing medical resources and overcrowding hospitals. In addition, it was shown that the COVID-19 survivors' median length of stay (LOS) was between 10 and 13 days [(4).]

Numerous studies have been conducted on COVID-19. Notably, researchers in China analyzed the factors influencing the severity and hospital stay length (LOS) for patients with moderate to severe COVID-19. Their findings indicated that the use of glucocorticoids led to an extended duration of hospitalization [(5)].

A retrospective investigation conducted in Vietnam, in addition to China, revealed a strong correlation between age, place of residence, and sources of contamination and an extended hospital stay for COVID-19 patients during the second wave [(6)].

Up to this point, there has been a lack of information regarding the risk factors for the length of hospital stay (LOS) in Egypt. Therefore, we carried out a retrospective analysis of patients admitted with COVID-19 in a singular hospital setting, with the aim of identifying the elements that influence the duration of hospitalization.

## PATIENTS AND METHODS

This retrospective cohort study included a total of 300 patients with Covid 19, who were admitted to the 23 July Chest Hospital, El Marg Qaluobia Government. This study was conducted between october 2020 to september 2022.

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This study included patients who were admitted to ward, both sexes, aged >18 years, after exclusion of patients who were died during admission and patients not suspected to have COVID as presence of lobar pneumonia or pleural effusion and pneumothorax.

### *Confirmed Case:*

A patient who has had laboratory confirmation of COVID-19 infection by molecular testing (PCR) together with results indicative of COVID-19 illness on chest imaging, regardless of clinical signs and symptoms, and a



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deep nasal swab, the current test of choice for the diagnosis of acute COVID-19 infection.

**Moderate cases:**

- Pneumonia (lung infiltrates) < 50%.
- No hypoxia $SpO_2 \geq 92\%$.
- Presence of risk factor.

**Severe cases:**

- RR > 30
- Hypoxia SpO2 < 92% at room air.
- PaO2/ FiO2 ratio <300. - Chest radiology showed more than 50% lesion or progressive lesion within 24 to 48 hours.
- All patients were subjected to full history taking, complete clinical examination, laboratory investigations as complete blood count (CBC), C-reactive protein, D-dimer, liver function tests (ALT , AST, PT, PTT& INR), kidney function tests (urea & creatinine), radiological investigations as (chest X-ray and chest computed tomography (CT) scan). Naso-pharyngeal swab for detection of corona virus, reverse transcription polymerase chain reaction (RT-PCR)

**Ethical approval:**

**The Academic and Ethical Committee of Benha university approved the project (Ms 1-3-2022). Consent was given from the hospital to collect data from patients' files. The study was conducted in line with the Helsinki Declaration.**

***Statistical analysis***

Using the Statistical Package for Social Science (IBM Corp., Released 2017), the gathered data was updated, coded, and compiled. IBM Corporation, Armonk, NY, IBM SPSS Statistics for Windows, Version 25.0. According to the kind of data collected for each parameter, appropriate analysis was done after the data were presented. The parametric numerical data's mean, standard deviation (± SD), frequency, and percentage of non-numerical data are all included. The significance of the difference in means between the two study groups was evaluated statistically using the Student T Test. Two qualitative variables were compared using the Chi-Square test. To evaluate the degree of relationship between two quantitative variables, use correlation analysis. The linear relationship's strength and direction between two variables are defined by the correlation coefficient.Receiver operating characteristic, or ROC, curve gives.

**RESULTS**

This study included 300 patients with Covid 19. The mean length of hospital stay was 11± 4.58 days. Patients were divided according to length of hospital stay into 2 groups; **Not prolonged group;** included 170 patients (56.7%) with length of hospital stay < 11 days, and **Prolonged group;** included 130 patients (43.3%) with length of hospital stay $\geq$ 11 days**.( Table 1)**

**Table 1: COVID staging & hospital stay in the studied patients.**

| | | N=300 | % |
|---|---|---|---|
| **First diagnosis** | **Pneumonia** | 300 | 100.0% |
| **COVID stage** | **Mild** | 0 | 0.0% |
| | **Moderate** | 50 | 16.7% |
| | **Severe** | 250 | 83.3% |
| **Length of hospital stay (days)** | **Mean ±SD** | **Min.** | **Max.** |
| | 11± 4.58 | 5.00 | 20.00 |
| **Length of hospital stay (groups)** | **Not-prolonged < 11 days** | 170 | 56.7% |
| | **Prolonged $\geq$ 11 days** | 130 | 43.3% |

Patients of prolonged group were statistically older (61±11 years) than not prolonged group (48±13 years), (p <0.001). There was no statistical difference between groups regarding gender. Prolonged group had statistically higher frequencies of myalgia and throat pain compared to not prolonged group. While there were no statistical differences between groups regarding other presenting symptoms. Also, comorbidities, chronic diseases and smoking were common in prolonged than the other group.**( Table 2)**

**Table 2: Demographic and Clinical data of studied groups.**

| | | Length of hospital stay | | | | Test | P value |
|---|---|---|---|---|---|---|---|
| | | Not prolonged <11 days | | Prolonged ≥11 days | | | |
| | | N=170 | % | N=130 | % | | |
| **Gender** | **Male** | 94 | 55.3% | 65 | 50.0% | $X^2$=0.83 | 0.36 |
| | **Female** | 76 | 44.7% | 65 | 50.0% | | |
| **Age (years)** | **Mean ± SD** | 48±13 | | 61±11 | | t=9.4 | **<0.001*** |
| | **Range** | 26-76 | | 37-82 | | | |
| **Presenting symptom** | **Fever** | 80 | 47.1% | 45 | 34.6% | $X^2$=2.1 | 0.14 |
| | **Dyspnea** | 90 | 52.9% | 85 | 65.4% | | |
| **Symptoms** | **Fever** | 170 | 100.0% | 130 | 100.0% | - | - |
| | **Cough** | 170 | 100.0% | 130 | 100.0% | - | - |
| | **Myalgia** | 120 | 70.6% | 115 | 88.5% | $X^2$=8.2 | **0.041*** |
| | **Throat pain** | 40 | 23.5% | 70 | 53.8% | $X^2$=7.4 | **0.048*** |
| | **Fatigue** | 125 | 73.5% | 105 | 80.8% | $X^2$=2.1 | 0.14 |
| | **Chest congestion** | 130 | 76.5% | 110 | 84.6% | $X^2$=3.1 | 0.08 |
| | **GIT symptoms (abdominal pain, diarrhea)** | 55 | 32.4% | 50 | 38.5% | $X^2$=1.2 | 0.27 |
| | **Palpitation** | 20 | 11.8% | 20 | 15.4% | $X^2$=0.83 | 0.37 |
| | **Cutaneous manifestations** | 4 | 2.4% | 3 | 2.3% | $X^2$=0.13 | 0.95 |
| | **Anosmia** | 27 | 15.9% | 18 | 13.8% | $X^2$=0.45 | 0.73 |
| **History of contact** | **No** | 95 | 55.9% | 90 | 69.2% | $X^2$=4.5 | 0.09 |
| | **Yes** | 75 | 44.1% | 40 | 30.8% | | |
| **Chronic illness** | **DM** | 105 | 61.8% | 115 | 88.5% | $X^2$=16.8 | **<0.001*** |
| | **HTN** | 105 | 61.8% | 105 | 80.8% | $X^2$=12.6 | **<0.001*** |
| | **COPD** | 25 | 14.7% | 40 | 30.8% | $X^2$=11.2 | **0.001*** |
| | **IHD** | 24 | 14.1% | 37 | 28.5% | $X^2$=10.7 | **0.003*** |
| | **RA** | 8 | 4.7% | 2 | 1.5% | $X^2$=7.9 | **0.035*** |
| | **CKD** | 15 | 8.8% | 35 | 26.9% | $X^2$=6.7 | **0.009*** |
| | **CLD** | 30 | 17.6% | 25 | 19.2% | $X^2$=2.1 | 0.16 |
| **Smoker** | **No** | 145 | 85.3% | 90 | 69.2% | $X^2$=11.2 | **0.001*** |
| | **Yes** | 25 | 14.7% | 40 | 30.8% | | |
| **BMI (Kg/m$^2$)** | **Mean ± SD** | 27.5±3.1 | | 29.1±2.7 | | t=4.7 | **<0.001*** |
| | **Range** | 22.1-34.2 | | 23.2-32.4 | | | |
| **O2 saturation** | **Mean ± SD** | 88.7±3.6 | | 82.9±4.5 | | t=12.3 | **<0.001*** |
| | **Range** | 80-94 | | 75-91 | | | |
| **Heart rate (/min.)** | **Mean ± SD** | 88.9±5.6 | | 92.4±7.3 | | t=4.8 | **<0.001*** |
| | **Range** | 80-105 | | 75-110 | | | |
| **Respiratory rate (/min).** | **Mean ± SD** | 30.4±5.4 | | 33.7±6.3 | | t=4.9 | **<0.001*** |
| | **Range** | 25-45 | | 26-46 | | | |
| **Temperature ©** | **Mean ± SD** | 38.6±0.7 | | 38.7±0.6 | | t=2.4 | 0.11 |
| | **Range** | 37.9-40 | | 37.8-40 | | | |

$X^2$: Chi-square test, t: student t-test, *: significant, DM: diabetes mellitus; HTN: hypertension: COPD: chronic obstructive pulmonary disease, IHD: ischemic heart disease, CKD: Chronic kidney disease, CLD: Chronic liver disease,

Anemia, leucopenia, lymphopenia, thrombocytopenia were more common in prolonged group than the other group. Also, all patients in prolonged group showed elevated D-dimer and CRP with statistically significant difference**.** prolonged group had statistically higher frequencies of bilateral pulmonary infiltartion and consolidation compared with not prolonged group.**( Table 3)**

**Table 3: Laboratory investigations and radiological finding of studied groups.**

| | | Length of hospital stay | | | | Test | P value |
|---|---|---|---|---|---|---|---|
| | | Not prolonged <11 days | | Prolonged ≥11 days | | | |
| | | N=170 | % | N=130 | % | | |
| **Hemoglobin (g/dl)** | **Mean ±SD** | 11.7±1.4 | | 11.1±1.6 | | t=2.2 | **0.033*** |
| | **Normal** | 150 | 88.2% | 54 | 41.5% | | |
| | **Anemia** | 20 | 11.8% | 76 | 48.5% | $X^2$=15.7 | **<0.001*** |
| **WBCs (× $10^9$/L)** | **Mean ±SD** | 7.4±1.1 | | 8.5±1.5 | | t=2.7 | **0.010*** |
| | **Normal** | 118 | 69.4% | 37 | 28.5% | | |
| | **Leukopenia** | 36 | 21.2% | 59 | 45.4% | $X^2$=21.5 | **0.005*** |
| | **Leukocytosis** | 16 | 9.4% | 34 | 26.1% | | |
| **Lymphocytes (%)** | **Mean ±SD** | 21.9±2.1 | | 19.6±4.4 | | t=1.8 | 0.06 |
| | **Normal** | 55 | 32.3% | 5 | 3.9% | | |
| | **Lymphopenia** | 28 | 16.5% | 25 | 19.2% | $X^2$=7.4 | 0.12 |
| | **Lymphocytosis** | 87 | 51.2% | 100 | 76.9% | | |
| **Neutrophils (%)** | **Mean ±SD** | 86.1±2.9 | | 70.6±2 | | t=1.6 | 0.08 |
| | **Normal** | 130 | 76.5% | 81 | 62.3% | | |
| | **Neutropenia** | 24 | 14.1% | 22 | 16.9% | $X^2$=5.4 | 0.17 |
| | **Neutrophilia** | 16 | 9.4% | 27 | 20.8% | | |
| **Platelets (×$10^3$/l)** | **Mean ±SD** | 258±42 | | 237±45 | | t=4.3 | **<0.001*** |
| | **Normal** | 140 | 82.3% | 63 | 48.5% | | |
| | **Thrombocytopenia** | 24 | 14.1% | 67 | 51.55 | $X^2$=25.7 | **<0.001*** |
| | **Thrombocytosis** | 6 | 3.6% | 0 | 0.0% | | |
| **RBS (mg/dl)** | **Mean ±SD** | 187.5±7.7 | | 231.8±58.1 | | t=7.2 | **<0.001*** |
| | **Normal** | 130 | 76.5% | 43 | 33.1 | $X^2$=9.5 | **<0.001*** |
| | **Hyperglycemia** | 40 | 23.5% | 87 | 66.9% | | |
| **ALT (IU/L)** | **Mean ±SD** | 33.1±4.5 | | 32.2±5.3 | | t=0.68 | 0.49 |
| | **Normal** | 138 | 81.2% | 105 | 80.8% | $X^2$=0.67 | 0.77 |
| | **Increased** | 32 | 18.8% | 25 | 19.2% | | |
| **AST (IU/L)** | **Mean ±SD** | 30.4±3.2 | | 32.7±5.4 | | t=1.2 | 0.21 |
| | **Normal** | 138 | 81.2% | 105 | 80.8% | $X^2$=67 | 0.77 |
| | **Increased** | 32 | 18.8% | 25 | 19.2% | | |
| **D dimer (µg/ml)** | **Mean ±SD** | 0.6±0.15 | | 1.2±0.6 | | t=11.7 | **<0.001*** |
| | **Normal** | 119 | 70.0% | 0 | 0.0% | $X^2$=78.6 | **<0.001*** |
| | **Increased** | 51 | 30.0% | 130 | 100% | | |
| **CRP (mg/L)** | **Mean ±SD** | 35.6±5.4 | | 56.1±5.6 | | t=7.9 | **<0.001*** |
| | **Normal** | 93 | 54.7% | 0 | 0.0% | $X^2$=65.9 | **<0.001*** |
| | **Increased** | 77 | 45.3% | 130 | 100% | | |
| **Urea (mg/dl)** | **Mean ±SD** | 61.1±3.3 | | 55.4±3.5 | | t=1.6 | 0.08 |
| | **Normal** | 130 | 76.5% | 85 | 65.4% | $X^2$=4.7 | 0.15 |
| | **Increased** | 40 | 23.5% | 45 | 34.6% | | |
| **Creatinine (mg/dl)** | **Mean ±SD** | 1.2±0.6 | | 1.3±0.15 | | t=1.2 | 0.19 |
| | **Normal** | 155 | 91.2% | 109 | 83.8% | $X^2$=4.6 | 0.18 |
| | **Increased** | 15 | 8.8% | 21 | 16.2% | | |
| **CT chest** | **Ground glass** | 170 | 100.0% | 130 | 100.0% | - | - |
| | **Bilateral pulmonary infiltration** | 90 | 52.9% | 115 | 88.5% | $X^2$=43.7 | **<0.001*** |
| | **Consolidation** | 30 | 17.6% | 95 | 73.1% | $X^2$=92.4 | **<0.001*** |
| **COVID stage** | **Mild** | 0 | 0.0% | 0 | 0.0% | $X^2$=48.5 | **<0.001*** |
| | **Moderate** | 50 | 29.4% | 0 | 0.0% | | |
| | **Severe** | 120 | 70.6% | 130 | 100.0% | | |

$X^2$: Chi-square test, t: student t-test, *: significant

The length of hospital stay increased with increases RBS, D dimer, C reactive protein levels with positive correlation. While correlated negatively with decrease O2 saturation,WBCs, platelet count. **(Table 4,5)**

**Table 4: Correlation between length of hospital stay and clinical data.**

| | Length of hospital stay | |
|---|---|---|
| | **R** | **P value** |
| **Age (years) ≥61** | 0.555 | **<0.001*** |
| **BMI (Kg/m$^2$) ≥28.14** | 0.368 | **<0.001*** |
| **O2 saturation ≥86.2%** | -0.631 | **<0.001*** |
| **Heart rate/min ≥90.43** | 0.175 | 0.121 |
| **Respiratory rate/min.≥22** | 0.157 | 0.172 |
| **Temperature ≥38.66** | -0.118 | 0.091 |

**Table 5: Correlation between length of hospital stay and laboratory parameters.**

| | | Length of hospital stay (days) | Test | P value |
|---|---|---|---|---|
| | | **Mean ±SD** | | |
| **Hemoglobin (g/dl)** | **Normal** | 9.7±1.3 | t=3.6 | **0.026*** |
| | **Anemia** | 11.3±2.7 | | |
| **WBCs (×10$^9$/L)** | **Normal** | 9.6±1.4 | F=2.4 | 0.09 |
| | **Leukopenia** | 10.7±2.1 | | |
| | **Leukocytosis** | 11.1±1.8 | | |
| **Lymphocytes (%)** | **Normal** | 9.7±1.9 | F=1.7 | 0.165 |
| | **Lymphopenia** | 10.9±2.1 | | |
| | **Lymphocytosis** | 11.1±2.2 | | |
| **Neutrophils (%)** | **Normal** | 10.5±1.9 | F=1.6 | 0.224 |
| | **Neutropenia** | 10.8±1.6 | | |
| | **Neutrophilia** | 11.1±2.3 | | |
| **Platelets (×10$^3$/l)** | **Normal** | 9.3±2.1 | F=5.4 | **<0.001*** |
| | **Thrombocytopenia** | 9.2±1.4 | | |
| | **Thrombocytosis** | 12.7±3.2 | | |
| **RBS (mg/dl)** | **Normal** | 8.2±2.1 | t=4.7 | **<0.001*** |
| | **Hyperglycemia** | 13.4±2.6 | | |
| **ALT (IU/L)** | **Normal** | 10.3±2.5 | t=1.2 | 0.276 |
| | **Increased** | 10.9±2.8 | | |
| **AST (IU/L)** | **Normal** | 10.1±1.9 | t=1.8 | 0.08 |
| | **Increased** | 11.1±2.1 | | |
| **D dimer (µg/ml)** | **Normal** | 7.6±1.4 | t=7.3 | **<0.001*** |
| | **Increased** | 14.2±3.1 | | |
| **CRP (mg/L)** | **Normal** | 8.5±2.6 | t=4.2 | **<0.001*** |
| | **Increased** | 12.9±1.9 | | |
| **Urea (mg/dl)** | **Normal** | 10.3±2.1 | t=1.5 | 0.109 |
| | **Increased** | 10.8±1.9 | | |
| **Creatinine (mg/dl)** | **Normal** | 10.1±1.9 | t=1.7 | 0.09 |
| | **Increased** | 10.9±2.1 | | |

r: Correlation coefficient, *: significant, BMI: body mass index, RBS: random blood sugar, WBCs: white blood cells, ALT: Alanine transaminase, AST: Aspartate transaminase.

Age > 53.2 years, RBS > 206 mg/dl, D dimer > 0.85 µg/ml, c-reactive protein > 44.5 mg/dl and O2 saturation < 86% were significant independent predictor factors of prolonged hospital stay. **(table 6).**

**Table 6: Linear regression analysis for predictors of prolonged length of hospital stay**

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | P value |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| **(Constant)** | 54.948 | 13.150 | | 4.179 | **<0.001*** |
| **Age > 53.2 years** | 0.041 | 0.015 | 0.126 | 2.848 | **0.005*** |
| **BMI >28.14** | 0.040 | 0.065 | 0.025 | 0.622 | 0.534 |
| **RBS >206 mg/dl** | 0.008 | 0.003 | 0.103 | 2.546 | **0.011*** |
| **Hemoglobin <11.6 g/dl** | -0.196 | 0.125 | -0.064 | -1.565 | 0.119 |
| **Platelets <249 ×10$^3$/l** | -0.005 | 0.004 | -0.047 | -1.230 | 0.220 |
| **D dimer >0.85 µg/ml** | 2.386 | 0.370 | 0.268 | 6.449 | **<0.001*** |
| **C-reactive protein >44.5 mg/dl** | 0.033 | 0.007 | 0.174 | 4.467 | **<0.001*** |
| **O2 saturation <86%** | -0.313 | 0.039 | -0.339 | -7.982 | **<0.001*** |

To evaluate the effectiveness of D-dimer, C-reactive protein, and O2 saturation in predicting extended hospital stays, ROC (Receiver Operating Characteristic) analysis was employed. For D-dimer, with a threshold of > 0.7 µg/ml, the sensitivity reached 80.8%, and the specificity was 60%. In the case of C-reactive protein, at a cutoff point of >45 mg/L, it showed a sensitivity of 73.1% and a specificity of 81%. For O2 saturation, using a cutoff point of <88, the sensitivity was found to be 88.2% with a specificity of 63% (Figure1, 2).

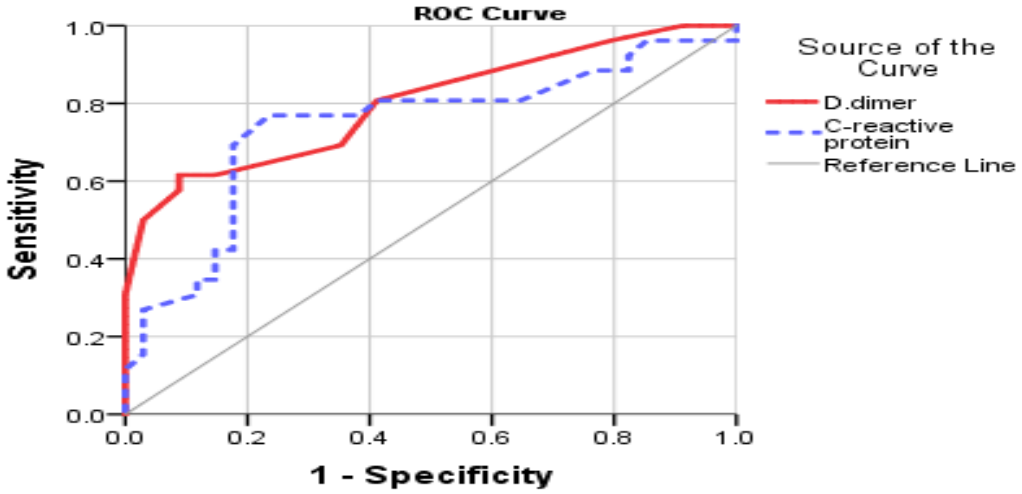


**Figure 1: ROC curve of performance of D dimer and C reactive protein for prediction of prolonged hospital stay**

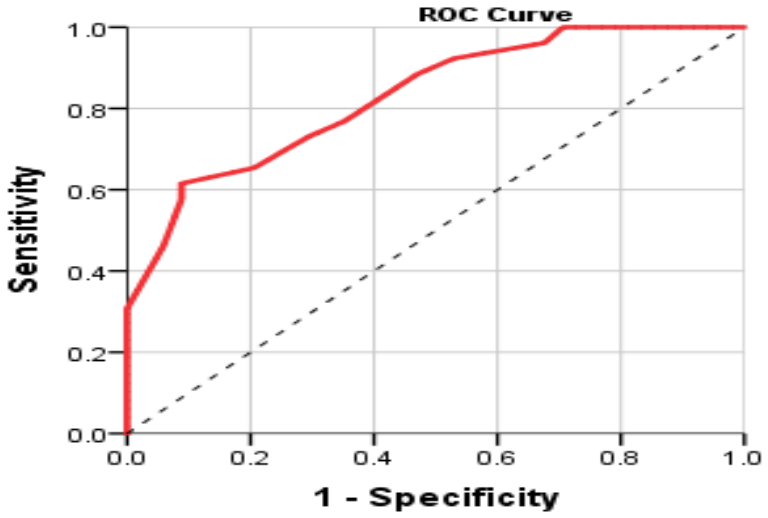


**Figure 2: ROC curve of performance of O2 saturation for prediction of prolonged hospital stay**

## DISCUSSION

This study included 300 patients with Covid 19, The mean length of hospital stay was 11± 4.58 days.

This was consistent with **Birhanu *et al.*** [7] who reported that the median length of hospital stay was 12 days with the IQR of 8–17 days. Similarly, **Zhou *et al.*** [8] reported a total hospital LoS (median 11.0, IQR 7.0–14.0) in COVID patients. However, **Chiam *et al.*** [9], reported that the median LOS of patients was 7.18 days (IQR: 3.86-12.15). The median LOS was 12.34 days (IQR: 8.68-20.10) and 5.72 days (IQR: 3.40-10.61) for ICU and non-ICU patients, respectively.

Patients were divided according to length of hospital stay into 2 groups; **Not prolonged** group; included 170 patients (56.7%) with length of hospital stay less than 11 days, and **Prolonged group**; included 130 patients (43.3%) with length of hospital stay more than 11 days. Prolonged group patients were statistically older (61±11 years) than not prolonged group (48±13 years), p <0.001. This was in agreement with **Pouw *et al.*** [10], who found that patients older than 70 years had an 8-day longer median length of ICU stay than patients younger than 60 years old. Our results were also matched with da **Costa Sousa. et al.** [11], who found that more length of hospitalization was associated with age over 62 years.

Our results weren't matched with **Guo *et al.*** [4], who reported that there was no significant difference between patients with prolonged and not prolonged hospital stay regarding age.

In the present study, prolonged group had higher statistically frequency of history of diabetes, hypertension, cardiovascular disease, chronic kidney diseases, chronic obstructive pulmonary disease, ischemic heart disease, and smoking compared to non prolonged group.

Our findings are consistent with those of da **Costa Sousa *et al.*** [11], who noted that patients with hypertension had a significantly longer average hospital stay (10.8 ± 8.4 days) compared to those without this comorbidity (8.53 ± 7.8 days), with a notable difference (P = 0.001). This aligns with the observations of **Wu *et al*.** [12], who identified a significant correlation between the length of hospital stay (LOS) and the presence of comorbidities, specifically cardiovascular disease, and diabetes.

In the present study, prolonged group had statistically higher frequencies of myalgia and throat pain, higher BMI, tachycardia, and tachypnea, and statistically lower O2 saturation compared with not prolonged group. While there was no statistical difference between groups regarding their temperature during admission.

**Alwafi *et al.*** [14] also found that a number of variables, such as fever (≥ 38°C), respiratory rate > 30, SPO2 <93, and heart rate more than 125 b/min, were linked to an increased risk of hospital stay. In the present study, patients with anemia, thrombocytopenia, high random blood sugar, high CRP, and high D- dimer had statistically longer duration of hospital stay. This was consistent with **Yang *et al.*** [13] who found that patients with COVID-19 infection were more likely to experience lymphopenia, sepsis, thrombocytopenia, and abnormal coagulation profiles. Lymphopenia was the most common blood count abnormality, occurring in 35–85% of patients.

In our study, prolonged group had statistically higher frequencies of bilateral pulmonary infiltration and consolidation compared with not prolonged group. Prolonged group had statistically higher disease severity compared with not prolonged group.

This was matched with **Wu *et al.*** [12], who observed that bilateral pneumonia on CT scan is associated with longer duration of hospital stay. In contrast, **Guo *et al.*** [4] found that disease severity and CT feature weren't significant risk factors of prolonged hospital stay, because his study included only mild cases. The length of hospital stay increased with old age, obesity, increases RBS, D dimer, C reactive protein levels with positive correlation. While correlated negatively with decrease O2 saturation, WBCs and platelets count. While it had no statistical correlation with other parameters.

Our results were matched with **Patil *et al.*** [17], who reported that D-Dimer level has significant association with longer duration of illness in covid-19 cases. Our results were nearly agreed with the study by **El Halabi *et al.*** [18], who reported similar findings. They identified several factors independently associated with a longer hospital stay. These included older age, with an odds ratio (OR) of 1.03 (range 1.02–1.04), chronic kidney disease (CKD) with an OR of 1.91 (1.35–2.71), higher maximum temperature (OR = 2.91 [2.40–3.53]), and lower minimum oxygen saturation (OR = 3.89 [3.16–4.79]).

In the present study, ROC analysis was done to assess the performance of D dimer for prediction of prolonged hospital stay; At a cutoff point ≥0.7 µg/ml, the sensitivity was 80.8% and specificity was 60%.

In the same line, **Alwafi *et al.*** [14]. Reported that in linear regression analysis; D- dimer value of more than >0.5, was a significant predictor of prolonged hospital stay. However, our results weren't matched with another studies **Poudel *et al.*** [15], **Yao *et al.*** [16], **Cidade *et al.*** [19] who didn't found a statistical difference between patients with normal D-dimer and elevated D- dimer regarding length of hospital stay. This may be explained as all these studies included survived and died cases and we included survived cases only.

In the current study, ROC analysis was done to assess the performance of C-reactive protein for prediction of prolonged hospital stay; At a cutoff point ≥45 mg/L, the sensitivity was 73.1% and specificity was 81%.

Our results were matched with **Stringer *et al.*** [20], who found that CRP levels ≥40.0 mg/L were associated with

31.9% mortality rate compared with 15.0% mortality in patients with CRP levels <40.0 mg/L. A previous investigation by **Liang *et al.* [21]**, involving 298 COVID-19 patients, revealed a stark contrast in initial C-reactive protein (CRP) levels between those who succumbed to the disease and survivors. The study found that deceased patients had CRP levels initially ten times higher than survivors (100.0 vs. 9.7 mg/L, P < 0.001). Furthermore, CRP concentrations were linked to mortality risk, as evidenced by an area under the receiver operating characteristic curve (AUC) of 0.896, indicating a strong predictive value. In our study, ROC analysis assessed the ability of O2 saturation to predict extended hospital stays. We determined that at a cutoff point of <88, the sensitivity was 88.2% with a specificity of 63%. These findings align with those of **Alwafi *et al.* [14]**, who noted that an $SPO_2$ level below 93 was significantly linked to an increased length of hospital stay.

However, our study does have certain limitations. Firstly, being a single-center study with a relatively small sample size, this might constrain the broader applicability of our results. Secondly, the retrospective cohort study design inherently raises the possibility of non-differential reporting errors among participants.

## CONCLUSION

The mean length of hospital stay in covid 19 patients was 11± 4.58 days ,medical comorbidities and smoking were associated with prolonged hospital stay. Old age, increase RBS, D dimer, C reactive protein and decrease O2 saturation are significant independent predictor factors of prolonged hospital stay.


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