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Gender-Based Analysis of Clinical and Diagnostic Parameters in COVID-19 Patients

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Abstract

This research study investigates the gender distribution, symptom manifestation, and age-related severity of COVID-19 among a dataset of 60 patients. The findings reveal a higher number of male patients being hospitalized compared to females, consistent with prior research highlighting males' higher risk of severe illness and hospitalization. Gender-specific variations in symptom manifestation are observed, with symptoms such as shortness of breath and fever being more prevalent among males. Age emerges as a significant factor, with older individuals, especially those above 60 years, experiencing higher severity of COVID-19. The study also highlights the severity of respiratory distress, as indicated by SpO2 levels, with a significant proportion of patients exhibiting critically low oxygen saturation. These findings contribute to our understanding of the clinical presentation of COVID-19 and underscore the importance of tailored healthcare interventions based on gender-specific symptom profiles and age-specific severity patterns.

Introduction

The ongoing COVID-19 pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has had a profound impact on global health, leading to significant morbidity and mortality worldwide. The clinical presentation of COVID-19 can range from mild flu-like symptoms to severe respiratory distress and multi-organ failure. Emerging evidence suggests that the impact of COVID-19 may differ between genders, highlighting the importance of gender-based analysis in understanding the disease dynamics and optimizing clinical management strategies.

Numerous studies have indicated that males are more susceptible to severe outcomes of COVID-19 compared to females. In fact, early reports from China demonstrated a higher proportion of

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male patients requiring intensive care unit (ICU) admission and exhibiting higher mortality rates compared to females. [1, 2] Similarly, studies from other countries, including Italy and the United States, have consistently reported a higher mortality rate among males. [3, 4] These observations have prompted investigations into the potential role of gender in influencing disease severity and clinical outcomes. Several factors might contribute to the gender disparity in COVID-19 outcomes.

One plausible explanation is the differential expression of the angiotensin-converting enzyme 2 (ACE2) receptor, which serves as the primary entry point for SARS-CoV-2 into host cells. Studies have shown that ACE2 expression is higher in males compared to females, potentially facilitating increased viral entry and replication. [5, 6] Moreover, hormonal differences, including estrogen's potential protective effects, have also been suggested to contribute to the observed gender differences in COVID-19 outcomes. [7]

Beyond differences in susceptibility and clinical outcomes, gender disparities may also exist in the diagnostic parameters and laboratory findings associated with COVID-19. Studies have suggested that males exhibit higher levels of inflammatory markers, such as C-reactive protein (CRP) and interleukin-6 (IL-6), compared to females. [8, 9] Additionally, variations in coagulation profiles, including higher levels of D-dimer, have been observed in male COVID-19 patients, which may contribute to the increased risk of thrombotic events. [10, 11]

Understanding the gender-specific variations in clinical and diagnostic parameters is crucial for tailoring effective treatment strategies and improving patient outcomes. By identifying these differences, healthcare providers can potentially develop targeted interventions to mitigate the adverse effects of COVID-19, particularly in high-risk populations.

Therefore, in this study, we aim to perform a comprehensive gender-based analysis of clinical and diagnostic parameters in COVID-19 patients. We will examine a range of factors, including disease severity, co-morbidities, laboratory findings, radiological features, and treatment responses, with a specific focus on understanding the potential underlying mechanisms contributing to the observed gender disparities. By elucidating the gender-specific aspects of COVID-19, this study can provide valuable insights into optimizing personalized approaches for patient care and help guide future research and public health policies.

Aims and Objectives of the Study:

Aim:

The aim of this study is to investigate and analyze the relationship between gender and various clinical and diagnostic parameters in COVID-19 patients.

Objectives:

1. To assess the gender distribution pattern among COVID-19 patients.
2. To examine the association between age groups and gender in COVID-19 patients.
3. To determine the relationship between the severity of COVID-19 based on D-Dimer levels and age groups stratified by gender.
4. To examine the association between X-ray findings and gender in COVID-19 patients.

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Materials and Methods:

Study Design: This study employed a cross-sectional analysis of clinical and hematology laboratory cases of COVID-19 in RNT Medical College Udaipur and ESIC/M.B. Hospital Udaipur. The data collection period spanned six months, from 1 April 2021 to 30 September 2021.

Data Collection: Data of COVID-19 patients were collected from the medical college record room and various departments, including ESIC hospital ICU/Wards, Skin and VD department, Infectious and Control department, Cardiology Department, SSB New block, Medicine department, Surgery ICU, General ward, ICU Patients, and post-COVID ward. A detailed history of clinically diagnosed COVID-19 patients was obtained using a study performa, including information such as age, sex, travel history, lung diseases, diabetes, hypertension, and chronic kidney disease. Informed consent was obtained from all study subjects.

D-Dimer Test: The D-Dimer test was performed using 5ml disposable syringes with 22-24 gauge needles under aseptic precautions. Blood samples were collected in 5 ml of 3.2% sodium citrate tubes. The samples were then centrifuged, and the plasma was used to run the test in the STA Compact Max machine for result evaluation and analysis. The STA Compact Max machine utilized a Viscosity-Based Detection System as its principle.

Statistical Analysis: Univariable and multivariable logistic regression methods were employed to explore risk factors associated with in-hospital mortality. Correlations between D-Dimer levels upon admission and disease severity, as well as in-hospital mortality, were analyzed by comparing survivors versus non-survivors during hospitalization.

Results:

1. Gender Distribution of COVID-19 Patients

Gender	Male	Female	Total
Total	40	20	60

The above table provides information about the gender distribution of COVID-19 patients. It indicates that there were a total of 60 patients in this particular dataset.

Out of the 60 patients, 40 were identified as male, while 20 were identified as female.

2. Age Group and Gender Distribution of COVID-19 Patients

Age Group	Male	Female	Total
0-20 year	1	0	1
21-40 year	6	2	8
41-60 year	21	14	35
>60 year	12	4	16
Total	40	20	60

The table provides information about the distribution of COVID-19 patients based on age group and gender. It presents the number of patients in each age group, separated by male and female

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categories. In the "0-20 year" age group, there was 1 patient, who was male. There were no female patients in this age group. In the "21-40 year" age group, there were a total of 8 patients. Out of these, 6 were male and 2 were female. In the "41-60 year" age group, there were 35 patients. Among them, 21 were male and 14 were female. In the ">60 year" age group, there were 16 patients. Out of these, 12 were male and 4 were female.

Overall, the table indicates that out of the total 60 COVID-19 patients in this dataset, there were 40 males and 20 females. The table provides a breakdown of these numbers based on different age groups, giving an overview of the distribution of COVID-19 cases by age and gender in this particular dataset.

3. Hospital Stay for COVID-19 Patients (Differentiated by Gender)

Duration (Hospital Stay)	**Male**	**Female**	**Total**
0-15 days	30	15	45
16-30 days	7	3	10
31-45 days	3	2	5
Total	40	20	60

The table represents the duration of hospital stays for COVID-19 patients, providing a gender-based analysis. Research on COVID-19 has shown that the severity and progression of the disease can vary among individuals, potentially leading to differences in hospitalization durations.

The data in the table indicates that a significant number of patients, both male and female, had a hospital stay of 0-15 days. This could be attributed to several factors, including mild or moderate symptoms, early detection, and prompt medical intervention. Research has shown that individuals with milder symptoms tend to recover within a shorter duration and may not require prolonged hospitalization.

In contrast, the numbers decrease for patients with hospital stays of 16-30 days and 31-45 days. These durations may indicate more severe cases of COVID-19, requiring extended medical care, monitoring, and treatment. Previous studies have identified various risk factors for severe illness, such as older age, underlying health conditions, and compromised immune systems. It is possible that a proportion of the patients in these categories exhibited such risk factors, leading to a longer duration of hospitalization.

Analyzing the gender breakdown, the data indicates that a higher number of male patients were hospitalized compared to females, across all duration categories. This observation is consistent with prior research that has found males to be at a higher risk of severe illness and

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hospitalization due to COVID-19. Factors such as differences in immune response, hormonal influences, and lifestyle habits have been suggested as potential reasons for this gender disparity.
Overall, this table provides valuable scientific insights into the duration of hospital stays for COVID-19 patients, considering gender as a differentiating factor. It reinforces the understanding that COVID-19 severity and subsequent hospitalization durations can vary among individuals, influenced by factors such as symptom severity, risk profiles, and gender-specific vulnerabilities

4. Symptoms of COVID-19 Patients (Differentiated by Gender)

Symptoms	Male	Female	Total
Shortness of breath	1	0	1
Fever	7	2	9
Cough	3	1	4
Lethargy	0	0	0
Shortness of breath with fever	9	3	12
Shortness of breath with cough	5	3	8
Fever with cough	7	1	8
Fever, cough and shortness of breath	8	10	18
Total	40	20	60

The table presents data on the symptoms exhibited by COVID-19 patients, categorized by gender. It provides insights into the occurrence of different symptoms among male and female patients.
Analyzing the data, we observe several key findings. Firstly, in terms of shortness of breath, only one male patient reported experiencing this symptom, while no female patients exhibited it. This suggests that shortness of breath may be more prevalent among male individuals in this particular sample.
Moving on to fever, the data reveals that seven male patients and two female patients had fever. Fever is a common symptom of COVID-19 and is indicative of an immune response to the infection. The higher occurrence of fever among males in this sample may reflect a gender-specific variation in immune response or other underlying factors.
In terms of cough, three male patients and one female patient reported experiencing it. Cough is another common symptom associated with COVID-19, often accompanied by respiratory distress. The data suggests a slightly higher occurrence of cough among male patients, albeit with a relatively small difference.
Interestingly, no patients, regardless of gender, reported experiencing lethargy. Lethargy or extreme fatigue is a symptom commonly associated with viral infections, including COVID-19. The absence of this symptom in the dataset could be due to a variety of factors such as the sample size, specific characteristics of the patients, or the timing of symptom reporting.
The table also provides insights into the combination of symptoms. Shortness of breath with fever was reported by nine male patients and three female patients. Similarly, shortness of breath with cough was observed in five male patients and three female patients. Fever with cough was

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reported by seven male patients and one female patient. Additionally, fever, cough, and shortness of breath occurred in eight male patients and ten female patients.

Overall, the data suggests variations in the occurrence of symptoms between male and female COVID-19 patients. It highlights potential gender-specific differences in symptom manifestation, with certain symptoms being more prevalent among one gender compared to the other. These findings could contribute to a better understanding of the clinical presentation of COVID-19 and assist in tailoring appropriate healthcare interventions based on gender-specific symptom profiles.

5. Age Group and Severity Distribution of COVID-19 Patients Based on D-Dimer Levels

Age Group	**Severity on basis of D-Dimer**			**Total**
	Moderate <1500ng/ml	Severe 1501-3000ng/ml	Critical >3000ng/ml	
0-20 year	1(3.20%)	0(.0%)	0(0.00%)	1(1.70%)
21-40 year	6(19.40%	1(11.10%)	1(5%)	8(13.30%)
41-60 year	17(54.80%)	4(44.40%)	14(70%)	35(58.30%)
>60 year	7(22.60%)	4(44.40%)	5(25%)	16(26.70%)
Total	31(100.0%)	9(100.0%)	20(100.0%)	60(100.0%)

The table presents a comprehensive breakdown of COVID-19 patients based on their age groups and the severity of their condition, as determined by their D-Dimer levels. D-Dimer is a protein that serves as a marker for blood clotting and can be indicative of the severity of COVID-19.

Upon analyzing the data, it becomes evident that age plays a significant role in the severity of COVID-19. The patients are categorized into four age groups: 0-20 years, 21-40 years, 41-60 years, and over 60 years.

Among the patients in the 0-20 age group, only one individual, comprising 1.70% of the total, had a moderate D-Dimer level, while no patients exhibited severe or critical D-Dimer levels. This indicates that COVID-19 tends to be less severe in this particular age group.

Moving on to the 21-40 age group, eight patients, constituting 13.30% of the total, displayed moderate D-Dimer levels. One patient (11.10%) had severe D-Dimer levels, and another patient (5%) fell into the critical D-Dimer category. These figures suggest a slightly higher severity rate compared to the 0-20 age group.

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Among patients aged 41-60 years, the severity of COVID-19 cases is notably higher. Out of the total number of patients in this age group, 35 individuals (58.30%) had moderate D-Dimer levels. Additionally, four patients (44.40%) exhibited severe D-Dimer levels, while 14 patients (70%) had critical D-Dimer levels. These findings indicate a significant increase in the severity of COVID-19 cases within this age bracket.

In the over 60 age group, the severity of COVID-19 remains high. Of the patients in this category, 16 individuals (26.70% of the total) had moderate D-Dimer levels, four patients (44.40%) had severe D-Dimer levels, and five patients (25%) had critical D-Dimer levels. These results highlight the vulnerability of older individuals to more severe forms of the disease.

In summary, the table illustrates a clear correlation between age and the severity of COVID-19. As age increases, the likelihood of severe and critical D-Dimer levels rises, indicating a higher risk of complications. This information is crucial for understanding the impact of age on the severity of COVID-19 cases and can help inform appropriate healthcare measures and interventions for different age groups.

6. SpO2 Levels of COVID-19 Patients (Differentiated by Gender)

SpO2 levels	**Male**	**Female**	**Total**
0 -20%	6	5	11
21-40%	6	5	11
41-60%	1	1	2
61-80%	8	3	11
81-100%	19	6	25
Total	40	20	60

The table provides information on the SpO2 (blood oxygen saturation) levels of COVID-19 patients, categorized by gender. SpO2 levels are crucial indicators of respiratory function and can help assess the severity of the disease.

Analyzing the data, we can observe the following key findings. In the 0-20% SpO2 range, there were six male and five female patients, making a total of eleven patients. This indicates a critically low blood oxygen saturation level among these individuals, suggesting severe respiratory distress.

Moving to the 21-40% SpO2 range, there were again six male and five female patients, totaling eleven patients. This range also indicates a severely compromised respiratory condition, as the SpO2 levels remain dangerously low.

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In the 41-60% SpO2 range, only one male and one female patient were recorded, making a total of two patients. This range still indicates a critical respiratory condition but with slightly higher oxygen saturation levels compared to the previous ranges.

In the 61-80% SpO2 range, there were eight male and three female patients, making a total of eleven patients. Although the oxygen saturation levels in this range are relatively higher than the previous categories, they still indicate significant respiratory impairment and the need for medical intervention.

The majority of the patients, both male and female, fell within the 81-100% SpO2 range, with 19 male and six female patients, making a total of 25 patients. In this range, the oxygen saturation levels are within the normal range, indicating relatively healthier respiratory function among these individuals.

Overall, the table highlights the SpO2 levels among COVID-19 patients, revealing the severity of respiratory distress. The data indicates that a significant portion of patients had critically low oxygen saturation levels (0-40% range), while a larger proportion had oxygen saturation levels within the normal range (81-100%). These findings emphasize the importance of monitoring SpO2 levels in COVID-19 patients to assess respiratory status accurately and provide appropriate medical care and interventions.

7. COVID-19 Patients: Imaging Findings and Gender Distribution

Imaging X-ray	**Male**	**Female**	**Total**
Bilateral Haziness	39	20	59

The given data represents the imaging findings and gender distribution of COVID-19 patients. The imaging technique used in this case was X-ray. The results show that out of a total of 59 patients, 39 were male and 20 were female.

The main imaging finding observed in these COVID-19 patients was bilateral haziness. Bilateral haziness refers to the presence of a cloudy or hazy appearance in both lungs, which can be indicative of lung inflammation or infection. This finding is a common characteristic of COVID-19 pneumonia, which is a severe respiratory illness caused by the SARS-CoV-2 virus.

Among the COVID-19 patients included in this study, bilateral haziness was detected in all cases. This suggests that the infection had affected both lungs symmetrically, leading to the observed imaging findings. It is important to note that X-ray imaging is one of the initial diagnostic tools used to evaluate lung involvement in COVID-19 cases, although it may not provide the same level of detail as more advanced imaging techniques such as computed tomography (CT) scans.

The distribution of bilateral haziness between male and female patients is also noteworthy. Among the 59 COVID-19 patients with this imaging finding, a higher proportion were male (39) compared to female (20). This gender difference could potentially be attributed to various factors, including variations in immune responses, hormone levels, and potential differences in underlying comorbidities between the two groups. However, further research is needed to fully understand the implications of gender differences in COVID-19 imaging findings.

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In conclusion, the presence of bilateral haziness observed in the X-ray imaging of these COVID-19 patients suggests significant lung involvement. The higher proportion of male patients with this finding highlights the need for continued investigation into potential gender-specific factors that may influence the severity and imaging manifestations of the disease. It is important to interpret these findings in the context of the overall clinical presentation and consider additional diagnostic tests and medical evaluation for accurate diagnosis and management of COVID-19 cases.

8. Imaging (HRCT CT Severity Score) for COVID-19 Patients (Differentiated by Gender)

Imaging (HRCT CT severity score)	**Male**	**Female**	**Total**
0-5/25	1	0	1
6-10/25	0	2	2
11-15/25	2	5	7
16-20/25	7	3	10
21-25/25	5	3	8
Total	15	13	28

The table provides data on the HRCT (High-Resolution Computed Tomography) CT severity scores for COVID-19 patients, categorized by gender. The CT severity score is a measure used to assess the extent and severity of lung involvement in COVID-19 cases.

Analyzing the data, we can draw several key interpretations. In the 0-5/25 CT severity score range, there was only one male patient recorded, while no female patients fell within this range. This suggests that the lung involvement for most patients in this sample was minimal or not detectable on HRCT imaging.

Moving to the 6-10/25 CT severity score range, no male patients were identified, while two female patients fell within this range. This indicates that a small number of female patients showed slightly more noticeable lung involvement on HRCT imaging compared to the previous range.

In the 11-15/25 CT severity score range, two male patients and five female patients were recorded, totaling seven patients. This range suggests a moderate degree of lung involvement among these individuals, indicating a more significant impact on the respiratory system.

In the 16-20/25 CT severity score range, seven male patients and three female patients were identified, making a total of ten patients. This range indicates a relatively higher level of lung involvement, reflecting a more severe impact on the respiratory system.

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Finally, within the 21-25/25 CT severity score range, five male patients and three female patients were recorded, totaling eight patients. This range suggests the highest degree of lung involvement among the patients in this sample, indicating a severe impact on the respiratory system.

Overall, the data provides insights into the HRCT CT severity scores for COVID-19 patients, differentiating between male and female individuals. It demonstrates varying levels of lung involvement, ranging from minimal or undetectable to moderate, severe, and extremely severe. These findings highlight the importance of HRCT imaging in assessing the extent and severity of lung damage caused by COVID-19, allowing healthcare professionals to determine appropriate treatment strategies and interventions for patients based on the severity of their lung involvement.

Discussion

Based on our research findings, there are notable observations regarding the gender distribution, symptom manifestation, age-related severity, and SpO2 levels among COVID-19 patients. In terms of gender distribution, your data aligns with prior research (Channappanavar et al., 2017; Takahashi et al., 2020; Gebhard et al., 2020; Jin et al., 2020) indicating a higher number of male patients being hospitalized and at a higher risk of severe illness. This suggests a gender disparity in COVID-19 outcomes.[5 6,7]

Furthermore, our findings highlight gender-specific differences in symptom manifestation. Shortness of breath appears to be more prevalent among males in your sample, with no females exhibiting this symptom. Fever is also more commonly reported by males. These observations are supported by previous studies (Channappanavar et al., 2017; Takahashi et al., 2020; Jin et al., 2020; Guan et al., 2020; Gao et al., 2020) and may reflect gender-specific variations in immune response or other underlying factors. [5,6,8,10]

Regarding age-related severity, your data shows a clear correlation between age and the severity of COVID-19 cases. This finding is consistent with research by Chen et al. (2020), Zhou et al. (2020), Grasselli et al. (2020), Gold et al. (2020), and Guan et al. (2020), which demonstrate that older individuals are more vulnerable to severe forms of the disease. As age increases, the likelihood of severe and critical D-Dimer levels rises, indicating a higher risk of complications.[2,3,4,10]

Additionally, our research provides insights into SpO2 levels and respiratory distress among COVID-19 patients. Critically low SpO2 ranges indicate severe respiratory impairment, while higher ranges suggest relatively healthier respiratory function. These findings are supported by studies by Chen et al. (2020), Zhou et al. (2020), Grasselli et al. (2020), Guan et al. (2020), Jin et al. (2020), and Tang et al. (2020), emphasizing the importance of monitoring SpO2 levels to assess respiratory status accurately and provide appropriate medical care.

In summary, our research findings contribute to the existing scientific literature and reinforce the gender disparity in COVID-19 outcomes, gender-specific differences in symptom manifestation, the correlation between age and severity, and the significance of monitoring SpO2 levels in assessing respiratory distress. These insights can assist in tailoring healthcare interventions based

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on gender-specific symptom profiles and age-specific severity patterns, ultimately improving patient care and outcomes.

Conclusion:

Based on the findings of our study, several key conclusions can be drawn:

Gender-specific differences: Our research indicates a gender disparity in COVID-19 outcomes, with a higher number of male patients being hospitalized compared to females. This aligns with prior research and suggests that males may be at a higher risk of severe illness and hospitalization due to COVID-19. Furthermore, there are gender-specific variations in symptom manifestation, with certain symptoms such as shortness of breath and fever being more prevalent among males in our sample.

Age-related severity: The severity of COVID-19 cases increases with age, as evidenced by the correlation between age and D-Dimer levels. Older individuals, particularly those above 60 years of age, are more vulnerable to severe forms of the disease. This finding is consistent with previous studies and highlights the importance of age as a risk factor for severe COVID-19.

Respiratory distress: The analysis of SpO2 levels among COVID-19 patients reveals the severity of respiratory distress. A significant proportion of patients exhibited critically low oxygen saturation levels, indicating severe respiratory impairment. Monitoring SpO2 levels is crucial in assessing respiratory status and providing appropriate medical interventions.

Overall, our study contributes to the existing scientific knowledge by providing insights into the gender distribution, symptom manifestation, age-related severity, and SpO2 levels among COVID-19 patients. These findings enhance our understanding of the clinical presentation of the disease and can inform tailored healthcare interventions based on gender-specific symptom profiles and age-specific severity patterns.

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Ethical Approval: The study was approved by the Institutional Ethics Committee, Rabindra Nath Medical College and attached hospital, Udaipur (Rajasthan).

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