Original Article

Outcome of pregnant women admitted to critical care unit with confirmed severe COVID-19

A center experience

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ABSTRACT

الأهداف: استكشاف سمات وعوامل الخطر لدى النساء الحوامل اللاتي يتم إدخالهن إلى وحدات العناية المركزة (ICUs) المصابات بكوفيد19-. علاوة على ذلك، تصنف الدراسة النتائج بناءً على مستويات مختلفة من الدعم التنفسي المطلوب أثناء إقامتهم في العناية المركزة.

المنهجية: شملت هذه الدراسة الوصفية بأثر رجعي جميع النساء الحوامل المصابات بكوفيد19- اللاتي تم إدخالهن إلى وحدة الرعاية الحرجة للبالغين في مستشفى متخصص من الدرجة الثالثة في الرياض، المملكة العربية السعودية. خلال الفترة من يناير 2020م وديسمبر 2022م. تم تحديد ما مجموعه 38 امرأة حامل وكانوا مؤهلين لدراستنا.

النتائج: كان متوسط عمر المرضى 32.9 (19-45) سنة، وكان متوسط درجة التقييم الفسيولوجي الحاد والصحة المزمنة -21) 49.9 (APACHI IV IV 106). حوالي 60.5% من المرضى عانوا من العدوى المتراكبة أثناء إقامتهم في وحدة العناية المركزة. تم ولادة حوالي 81.6% من المرضى عن طريق العمليات القيصرية، ونجا 33 من المواليد الجدد، وتوفي 5. كان معدل الوفيات بين النساء الحوامل في مجموعتنا 15.8%. تم إخراج المرضى الذين عولجوا بالقنية الأنفية عالية التدفق (HFNC) في الغالب من المستشفى أو تم ولادتهم بشكل طبيعي، في حين خضعت مجموعات التهوية الميكانيكية (MV) والأكسجة الغشائية خارج الجسم في الغالب لعمليات قيصرية. وكان معظم الأطفال حديثي الولادة الباقين على قيد الحياة على HFNC وMV. كان المرضى الذين يعانون من حالات عدوى متعددة أطول فترة إقامة في وحدة العناية المركزة وكان لديهم أعلى خطر للوفاة.

الخلاصة: تسلط نتائج هذه الدراسة الضوء على خصائص النساء الحوامل اللاتي يتم إدخالهن إلى وحدة العناية المركزة في أحد مراكز الرعاية الصحية المتخصصة في المملكة العربية السعودية. تنبأت نتائجAPACHI IV بدقة بوفيات المريض، ومدة MV، ومدة الإقامة في وحدة العناية المركزة. في دراستنا، شاركنا تجربتنا في إدارة حالات العدوى الشديدة بكوفيد19- لدى المرضى الحوامل.

Objectives: To explore the traits and risk factors of pregnant women admitted to intensive care units (ICUs) with COVID-19. Moreover, the study classifies outcomes based on differing levels of required respiratory support during their intensive care stay.

Methods: This retrospective and descriptive study included all pregnant women with COVID-19 admitted to the adult critical care unit at a specialized tertiary hospital in Riyadh, Saudi Arabia. Between January 2020 and December 2022. A total of 38 pregnant women were identified and were eligible for our study.

Results: The mean age of the patients was 32.9 (19-45) years, and the average Acute Physiology and Chronic Health Evaluation IV (APACHI IV) score was 49.9 (21-106). Approximately 60.5% of the patients suffered from superimposed infections during their ICU stay. Approximately 81.6% patients were delivered by C-section, 33 of the newborns survived, and 5 died. The crude mortality rate among pregnant women in our cohort was 15.8%. Patients treated with high-flow nasal cannula (HFNC) were mostly discharged or delivered normally, while the mechanical ventilation (MV) and extracorporeal membrane oxygenation groups mostly underwent C-sections. Most of the surviving newborns were on HFNC and MV. Patients with multiple infections had the longest ICU stay and had the highest risk of death.

Conclusion: The results of this study highlight the characteristics of pregnant women admitted to the ICU at a specialized tertiary healthcare center in Saudi Arabia. The APACHI IV scores accurately predicted patient's mortality, duration of MV, and length of ICU stay. In our study, we shared our experience of managing severe COVID-19 infections in pregnant patients.

Keywords: intensive care unit, COVID-19, clinical features, mortality, pregnancy, ICU intervention

Saudi Med J 2024; Vol. 45 (4): 379-386
doi: 10.15537/smj.2024.45.4.20240022

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Received 8th January 2024. Accepted 16th February 2024.

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The COVID-19 pandemic has heavily burdened intensive care units (ICUs) worldwide. Pregnant women with COVID-19 have demonstrated a higher need for critical care admission and mechanical ventilation (MV) compared to non-pregnant patients.[1,2] According to a meta-analysis, maternal ICU admission rates ranged from 3-28.5% and MV rates from 1.4-12%. The same study also revealed that maternal mortality was below 2%, with most cases occurring in the third trimester.[3] Physiological changes during pregnancy may increase the risk of respiratory infections and pneumonia.[1] These alterations can also slow down the immune system response, cardiovascular functions, and coagulation. The mortality rate for pregnant and postpartum women with COVID-19 was 1.3%, with 20% of these cases having comorbidities. Risk factors that elevate the chance of death include being older than 35, diabetes, obesity, cardiovascular disease, and bronchial asthma.[2] Furthermore, COVID-19 severity in preganat women with COVID-19 is associated with non-vaccination (10 fold increased risk), blood type other than O, maternal age of >35 years, history of chronic hypertension, gestational age at infection ≥31 weeks, and multiparity.[4] Fever, with or without cough, was the most common symptom among pregnant women with COVID-19. Other frequently reported symptoms included shortness of breath and muscle pain, while sore throats and gastrointestinal symptoms were rare.[1]

Pregnant women with COVID-19 face an increased risk of complications such as preeclampsia, stillbirth, premature birth, and admission to the neonatal ICUs (NICUs).[2] Studies have shown that premature delivery occurred in between 14.3-63.8% of such cases, while rates for cesarean section (C-section) ranged from 52.3-95.8%.[3] The care management for critically ill pregnant and postpartum women diagnosed with COVID-19 presents significant challenges. There are limited studies detailing the methods of respiratory support used in these cases. These methods can range from high-flow nasal cannulas (HFNC) and noninvasive positive-pressure ventilation to endotracheal intubation, MV, and extracorporeal membrane oxygenation (ECMO). Extracorporeal membrane oxygenation, in particular, has proven successful in providing respiratory support for critically ill pregnant and postpartum women.[5-8]

Disclosure. Authors have no conflict of interests, and the work was not supported or funded by any drug company.

Few studies exist on managing critically ill pregnant patients with severe COVID-19 and their survival rates. Our study explores the traits and risk factors of pregnant women admitted to ICUs with COVID-19. Moreover, the study classifies outcomes based on differing levels of required respiratory support during their intensive care stay.

Methods. This is a retrospective, descriptive study focusing on pregnant women with COVID-19 who were admitted to the critical adult care unit at a specialized tertiary hospital in Riyadh, Saudi Arabia. Data were gathered from electronic medical records from January 2020 to December 2022. Ethical approval for the study was granted by the center's Ethics Committee board (IRB22-039). The collected data included patient demographics, comorbidities, types of delivery, newborn statuses, ICU stay length, hospital stay length, MV days, and other respiratory support modalities. Our study only included pregnant women with COVID-19 who required intensive care. Exclusions were carried out for pregnant women with COVID-19 who did not require intensive care or for those admitted to intensive care for reasons unrelated to COVID-19.

Statistical analysis. We used SAS (version 9.4) and GraphPad (version 9.0) to store and analyze all acquired data. To evaluate patients' demographic and clinical features, we employed both inferential and descriptive statistics. Numerical variables have been presented as team averages with median (range) and T-test results. We reported categorical variables as counts (percentages) and tested them using the Chi-square test.

Results. The study included 38 patients with an average age of 32.9 years, ranging from 19-45 years. The average gestational age at the point of ICU admission was 29.3 weeks. Among these patients, 5 had diabetes, and one had hypertension. Their average body mass index (BMI) was 32.4, with the range falling between 22.3-54.2. None of the patients were in their first trimester, with 47.4% in their second trimester and the remaining 52.6% in their third trimester. A summary of the patients' characteristics is provided in Table 1.

Patients were also evaluated using Acute Physiology and Chronic Health Evaluation (APACHE) IV scores; the mean score for our ICU group was 49.9, ranging between a minimum of 21 and a maximum of 106. On average, patients stayed in our unit for 20.5 days. The majority of patients (60.5%) suffered from co-infections, while 26.3% battled an infection from a single organism, and 34.2% were infected by multiple organisms. For the delivery procedure, a notable 81.6%

Table 1 - Summary statistics of the patient's clinical and demographical data (N=38).

Variables	n (%)
AGE, mean (min-max)	32.9 (19.0-45.0)
BMI, mean (min-max)	32.4 (22.3-54.2)
APACHE 4 score, mean (min-max)	49.9 (21.0-106.0)
Length admission (days), mean (min-max)	28.1 (3.0-105.0)
Length ventilation admission (days), mean (min-max)	16.1 (0.0-97.0)
Length ICU admission (days), mean (min-max)	20.5 (1-101)
Lab tests upon admission, mean (minimum-maximum)	
FiO2 (%)	0.82 (0.4-1.0)
pO2	69.0 (44.9-177.0)
pCO2	37.0 (22.1-64.7)
Arterial pH	7.4 (7.1-7.6)
Na+ (mEq/L)	140.5 (135.0-154.0)
Urine output	1225.1 (1.0-2380.0)
Creatinine (uml/l)	38.9 (17.0-56.0)
Urea (mEq/L)	3.7 (0.5-17.1)
BSL (mg/dL) glucose	123.5 (86.4-209.0)
Albumin (g/L)	27.5 (22.3-31.9)
Bilirubin (umol/L)	11.0 (3.7-49.4)
Ht (%)	31.6 (24.0-41.0)
WBC	10.9 (4.7-20.5)
Ventilation on admission	
HFNC	21 (55.3)
MV	13 (34.2)
NBM-15L	3 (7.9)
SFM	1 (2.6)
Did they receive HFNC during their stay	
No	14 (36.8)
Yes	24 (63.2)
Did they receive tracheostomy during their stay	
No	34 (84.2)
Yes	4 (15.8)
Did they receive MV during their stay	
No	9 (23.7)
Yes	29 (76.3)
Did they receive ECMO during their stay	
No	26 (68.4)
Yes	12 (31.6)

Values are presented as numbers and precentages (%) or mean (minimum-maximum). BMI: body mass index, APACHE: acute physiology and chronic health evaluation, ICU: intensive care unit, FiO2: raction of inspired oxygen, pO2: partial pressure of oxygen, pCO2: partial pressure of carbon dioxide, pH: potential of hydrogen, Na+: sodium, BSL: blood sugar test, Ht: hematocrit test, WBC: white blood cell, HFNC: high-flow nasal cannula, MV: mechanical ventilation, NBM-15L: non-rebreather mask, SFM: simple face mask, ECMO: extracorporeal membrane oxygenation, ER: emergency room, PE: pulmonary embolism, DVT: deep vein thrombosis

Table 1 - Summary statistics of the patient's clinical and demographical data (N=38). Continuation

Variables	n (%)
Maximum breathing support during ICU stay	
HFNC	9 (23.7)
MV	17 (44.7)
ECMO+MV	12 (31.6)
Patient's outcome	
Alive	31 (84.2)
Died	6 (15.8)
Trimester upon admission	
Second	18 (47.4)
Third	20 (52.6)
Newborn's outcome	
Alive	33 (86.8)
Died	5 (13.2)
Patients' comorbidity	
No	29 (76.3)
Yes	9 (23.7)
BMI groups	
Normal	5 (13.2)
Obese	24 (63.2)
Overweight	9 (23.7)
Patient's source	
ER	21 (55.3)
Transfer	17 (44.7)
ICU admission prior to delivery	
Day of delivery	8 (21.0)
Pregnant	30 (79.0)
PE status	
No	34 (84.2)
Yes	4 (15.8)
DVT status	
No	36 (94.7)
Yes	2 (5.3)

Values are presented as numbers and precentages (%) or mean (minimum-maximum). BMI: body mass index, APACHE: acute physiology and chronic health evaluation, ICU: intensive care unit, FiO2: raction of inspired oxygen, pO2: partial pressure of oxygen, pCO2: partial pressure of carbon dioxide, pH: potential of hydrogen, Na+: sodium, BSL: blood sugar test, Ht: hematocrit test, WBC: white blood cell, HFNC: high-flow nasal cannula, MV: mechanical ventilation, NBM-15L: non-rebreather mask, SFM: simple face mask, ECMO: extracorporeal membrane oxygenation, ER: emergency room, PE: pulmonary embolism, DVT: deep vein thrombosis

of patients required a C-section. Of the newborns, 33 survived, and 5 unfortunately did not. As such, our cohort yielded a crude mortality rate of 15.8%.

In our group, 15.8% were diagnosed with pulmonary embolism (PE) via computed tomography angiography, while 5.3% were identified with deep vein thrombosis using Doppler ultrasound.

With respect to ICU respiratory aid, the most commonly employed was MV, used in 44.7% of cases, followed by ECMO, at 31.6%, and HFNC, at 23.7%. During their stay, around 10% of patients needed renal support, 10% needed nitric oxide, and 7.9% required a tracheostomy.

The patient underwent various forms of respiratory support. We present data on the percentage of interventions that pregnant women with COVID-19 received in the ICU. The most commonly used respiratory aids were HFNC, MV, and ECMO.

The ECMO-treated group had the lowest average age. The APACHE IV scores were mostly lower for patients who received HFNC, while the MV and ECMO groups had higher scores. The patients in the MV and ECMO groups spent the most time in the ICU. A significant number of patients treated with MV and ECMO required a C-section. The ECMO support group had a low survival rate for newborns. However, the overall survival rate was highest in the HFNC and ECMO groups. Patients with co-infections in the HFNC and MV groups required more respiratory support compared to patients without infections.

We examined the maximum respiratory support modality used in the ICU based on individual patient characteristics. **Table 2** presents a summary of our findings. There was no noticeable correlation found between age, BMI, and the maximum number of respiratory support interventions required. Differently, the APACHI IV scores differed significantly among the groups; the HFNC group had the lowest mean of 28.1, while the MV+ECMO group had the highest at 69.9. The method of delivery showed a significant correlation with the respiratory support modality. Normal deliveries were prevalent in the HFNC group, while C-sections were common in the MV and ECMO groups. **Figure 1** provides a distribution of the patients' respiratory support needs based on their pregnancy stage. This reveals that among patients diagnosed in their third trimester, the majority required MV management, while fewer required ECMO, compared to those diagnosed in their second trimester.

The outcomes for the newborns notably varied by group, with the majority of survivors stemming from the HFNC and MV groups, while the ECMO group saw the highest mortality. Similar patterns were observed in patient survivorship by group: all in the HFNC group survived, one in the MV group passed away, and 5 deaths occurred in the ECMO group.

Figure 2A illustrates the correlation between co-infections in our cohort and their duration of stay in the ICU. It reveals that patients admitted for 10 days or less were not infected, while those who stayed longer contracted infections. Significantly, patients who had several infections not only stayed the longest in the ICU but also endured the highest mortality rate.

Table 2 - Summary of the ICU maximum respiratory support modality by patients' characteristics.

Variables	HFNC	MV	MV+ECMO	F or X^2 *p*-values
Age (mean)	33.9	34.0	30.8	0.30
BMI (mean)	30.5	33.1	32.9	0.61
APACHE 4 scores (mean)	28.1	46.1	69.9	0.0003*
ICU admission, days (mean)	4.3	19.2	34.6	0.007*
Hospital admission, days (mean)	10.6	26.2	43.9	0.002*
Delivery procedure				
Normal	1 (2.6)	1 (2.6)	0 (0.0)	0.0003*
C-section	3 (7.9)	17 (44.7)	11 (29.0)	
Discharge pregnant	5 (13.2)	0 (0.0)	0 (0.0)	
Newborn's status				
Alive	9 (23.7)	16 (41.1)	8 (21.1)	0.04*
Died	0 (0.0)	1 (2.6)	4 (10.5)	
Patient's status				
Survived	9 (23.7)	16 (41.1)	7 (18.4)	0.012*
Died	0 (0.0)	1 (2.6)	5 (13.2)	
Co-infections				
None	7 (18.4)	6 (15.8)	2 (5.3)	0.07
Single	1 (2.6)	4 (10.5)	5 (13.2)	
Multiple	1 (2.6)	7 (18.4)	5 (13.2)	
Antibiotic resistance				
No	9 (23.7)	15 (39.5)	10 (26.3)	0.46
Yes	0 (0.0)	2 (5.3)	2 (5.3)	
Comorbidity status				
No	7 (18.4)	11 (28.9)	11 (28.9)	0.24
Yes	2 (5.3)	6 (15.8)	1 (2.6)	

Values are presented as numbers and precentages (%) or means. *Denotes statistical significance at $p<0.05$ using Chi-square test.
HFNC: high-flow nasal cannula, MV: mechanical ventilation, ECMO: extracorporeal membrane oxygenation, BMI: body mass index, APACHE: acute physiology and chronic health evaluation, ICU: intensive care unit

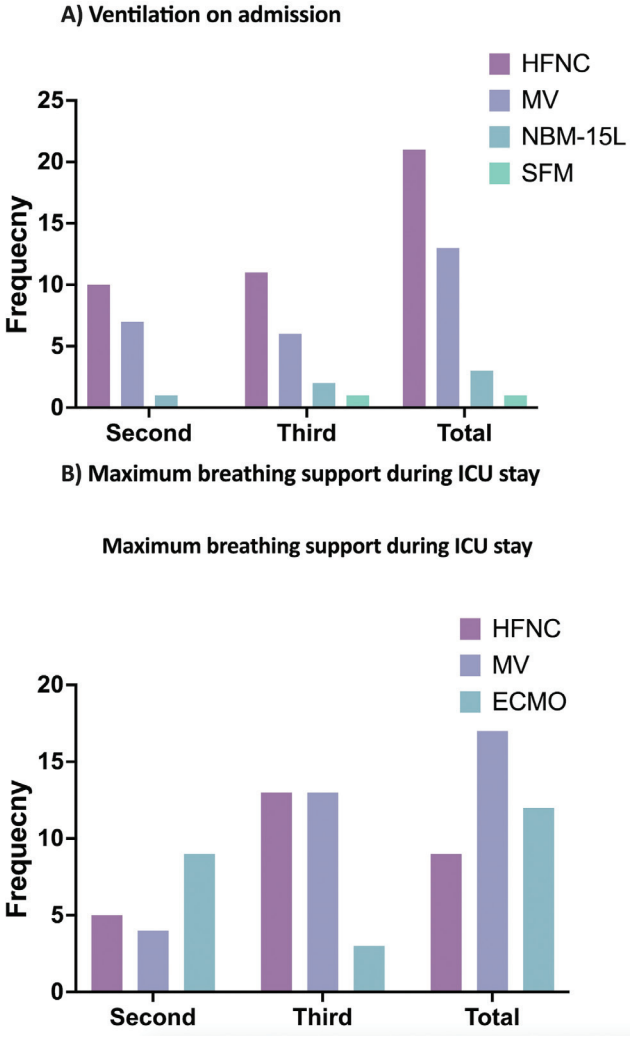

Figure 1 - The frequency bar graph of the intervention methods by trimester of the patients when admitted to the intensive care unit by maximum support. In the second trimester, most of the patients received extracorporeal membrane oxygenation support as the maximum support followed by high-flow nasal cannula. HFNC: high-flow nasal cannula, MV: mechanical ventilation, NBM-15L: non-rebreather mask, SFM: simple face mask, ICU: intensive care unit, ECMO: extracorporeal membrane oxygenation

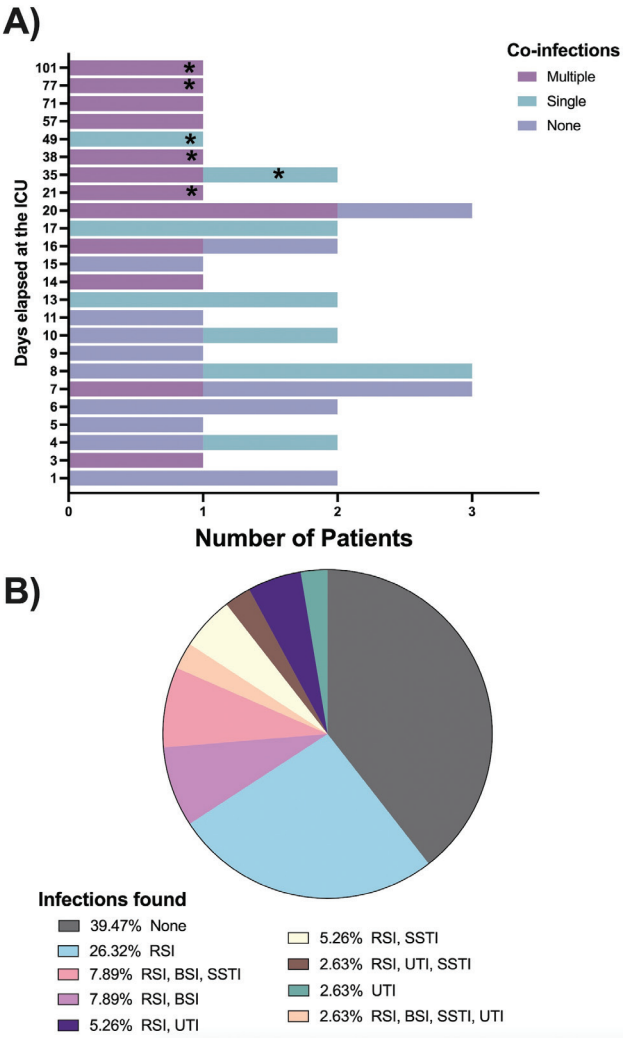

Figure 2 - The frequency of: **A)** the co-infections by days elapsed in the intensive care unit (the asterisk represents patient who died). **B)** Pie chart of the co-infections groups found at our intensive care unit cohort by percentages. ICU: intensive care unit, RSI: respiratory tract infection, BSI: bloodstream infection, SSTI: skin and soft tissue infections, UTI: urinary tract infection

Figure 2B presents the distribution and percentage of infections within the cohort groups. Just under half of the cohort (39.47%) were infection-free, while 34.21% had multiple infections, and 26.32% suffered from a single infection. Among those infected, a substantial majority (95.6%) developed respiratory tract infections (RSIs) in their lungs. The remaining portion primarily had multiple infections.

In our cohort, the living patients had no infections and required maximum ventilatory support in the ICU. All deceased patients had either single or multiple infections and needed ICU care for more than 20 days. Table 3 lists the most frequently detected organisms and specimen types, with *Klebsiella pneumoniae* being the most common (12.9%). It is followed by *Pseudomonas aeruginosa* and *Acinetobacter baumannii* (11%). This study found RSIs to be the most common infection source (47.7%), followed by blood and urine infections (20%), wound infections (9.1%), and bacterial infections.

We used APACHE IV scores to gauge illness severity in our study. There was a slight but significant correlation between these scores, MV usage, and length of ICU stay. Figure 3 demonstrates the weak positive

Table 3 - Organisms detected and specimen types detected in our cohort including multiple infection groups.

Organisms detected	n (%)
Klebsiella pneumoniae	8 (12.9)
Pseudomonas aeruginosa	7 (11.3)
Acinetobacter baumannii	7 (11.3)
Yeast	6 (9.7)
Candida albicans	5 (8.1)
Escherichia coli ESBL	5 (8.1)
Gram-positive bacteria COCCI	5 (8.1)
Candida auris	5 (8.1)
Staphylococcus aureus	3 (4.8)
MRSA	2 (3.2)
Enterococcus faecium	2 (3.2)
Candida Haemulonii	1 (1.6)
Stenotrophomonas maltophilia	1 (1.6)
Gram Negative Bacili	1 (1.6)
Candida glabrata	1 (1.6)
Klebsiella Carbapenem Resistant Enterobactericiae	1 (1.6)
Staphylococcus capitis	1 (1.6)
Enterobacter aerogenes	1 (1.6)
Specimen's type	
Respiratory and sputum	21 (47.7)
Blood	9 (20.5)
Urine	9 (20.5)
Wound	4 (9.1)
Vagina	1 (2.3)

Values are presented as numbers and precentages (%). ESBL: extended spectrum beta-lactamase, COCCI: Enterococci, MRSA: methicillin-resistant Staphylococcus aureus

correlation (R2=0.249, *p*=0.0016) between ventilation days and APACHE IV scores. The same pattern was noted for ICU admissions (R2=0.229, *p*=0.0027) and hospital stays (R2=0.212, *p*=0.0041).

Discussion. Between January 2020 and December 2022, 38 pregnant women were admitted to the ICU. The average age of these patients was 32.9 years, and they were typically in their 29th week of pregnancy. Significantly, 60.5% of the women had co-infections. Pulmonary embolism was diagnosed in 15% of the patients, while 81.6% required a C-section. Out of the newborns, 33 survived, and 5 did not. The mortality rate among the pregnant women in our group was 15.8%. Notably, only 9 (23.7%) out of the total patients had known pre-existing health conditions.

The severity of COVID-19 is influenced by factors like maternal age and pre-existing conditions such as diabetes, hypertension, gestational hypertension, preeclampsia, HELLP syndrome, heart disease, smoking, and a high BMI.[1,9] A thorough review of 62 studies covering 31,016 pregnant women disclosed

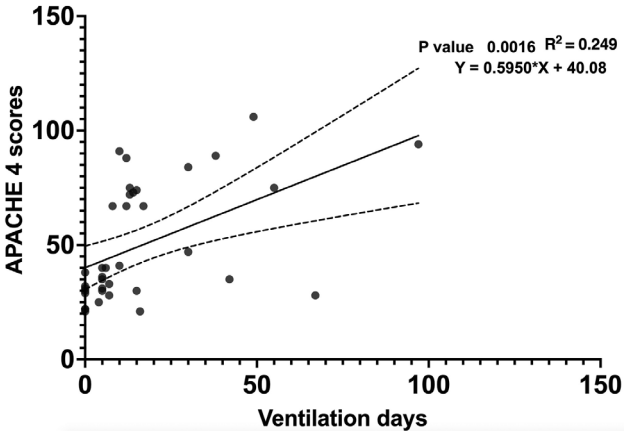

Figure 3 - Linear scatter plot of Acute Physiology and Chronic Health Evaluation IV scores by ventilation days. The correlation was significant with R2=0.249, the trend indicates with higher scores more ventilation days are needed. APACHE: acute physiology and chronic health evaluation

that 7% of pregnant women with COVID-19 were hospitalized in ICUs. Further, the study revealed the need for MV in 8% of cases, noninvasive ventilation in 15% of cases, and ECMO support in 0.3% of cases.[9]

Pregnant women with COVID-19 undergo many physiological changes during pregnancy, such as altered coagulation factors, thromboembolic events caused by an exaggerated inflammatory response against the virus.[10] In another study, the worst outcomes and maternal complications in pregnant women with COVID-19 was found in overweight, and women with comorbidities.[11] The study also revealed that from the 10 patients who underwent ECMO, only one survived and preterm labor was the most common pregnancy complication.

In our study population, a significant number of patients required MV (44.7%), with ECMO support following at 31.6%. In our study, we grouped patients based on their maximum need for respiratory aid. However, we found no significant correlation between the individuals' age and BMI and their requirement for maximum respiratory support. Even though the average age of our patients was 32.9 years and most were in good health prior, there was a notable inclination towards the need for MV. Two-thirds of our patients exhibited severe symptoms, necessitating MV, while less than one-half required an ECMO intervention.

Our hospital, a tertiary care referral center in Riyadh, Saudi Arabia, with critical care facilities and specialized women's clinics, received 44% of the cases studied here from other facilities amid the pandemic. In our study, we recorded the APACHI IV score for our patients

within 24 hours of admission. The average score was 49.9, illustrating a significant positive correlation between lengthy ventilation periods and ICU admission. Another study reported an APACHI IV score and length of stay similar to ours. However, our hospital stays were markedly extended.[12] Similar to APACHI scores, one study used systemic immune-inflammation index (SII) and systemic immune-response index (SIRI) to study the adverse perinatal outcomes in pregnant women with (COVID-19).[13] The study found that both indicators might be used in combination with other clinical findings in the prediction of poor perinatal outcomes including pregnancy complications, NICU admission, and maternal mortality. Moreover, severe COVID-19 cases were shown to have significantly higher rates of inflammatory markers.[13]

Our research found that 60.5% of patients in our study, which focused on pregnant women with COVID-19 in the ICU, suffered from co-infections during their illness. The most common source of these co-infections was a pulmonary infection, present in 47.7% of cases. Pregnant women who were admitted to critical care had a higher infection rate of 60.5%.

Parallel findings were seen in a retrospective international study carried out in France, Belgium, and Switzerland, which included 187 pregnant women with COVID-19 admitted to the ICU. Of these, 62% (n=117) experienced ICU-related complications, with co-infections listed as a primary issue.[14]

Another observational study of 133 COVID-19 patients found that 25.9% had bacterial or fungal co-infections.[15] Identified risk factors for developing these co-infections included severity of illness (indicated by a higher APACHE III score) and vasopressor usage. Patients with co-infections experienced higher mortality rates and longer hospital stays. Infection risks also increased after 7 days in the ICU, particularly with the use of a vasopressor, corticosteroid, central line, or Foley catheter.[15]

The incidence of infection with multi-drug resistant organisms was high in our study, and it correlated positively with length of stay. Most co-infections were respiratory, and multiple co-infections were linked to extended hospital stays and increased mortality.

A United Kingdom study of 4,436 pregnant women with COVID-19 showed that 14% experienced severe infections, increasing their chances of pre-labor C-section and extremely preterm birth (28-31 weeks gestation). Babies had an increased probability of stillbirth.[16]

A retrospective Saudi Arabian study surveyed 288 pregnant women with COVID-19 admitted to 3 hospitals. Of these, 204 women delivered; 11 cases needed ICU admission. While no neonatal outcomes were reported for this specific subgroup, 35.8% required C-sections. Premature delivery (15.5%) accounted for the most adverse pregnancy outcome, followed by fetal distress (6.5%), and 4 neonatal fatalities were reported. Approximately 86.4% of neonates were admitted to the NICU.[17] Our study recorded a total of 5 neonatal deaths, with all mothers needing high respiratory support.

The management of pregnancy specific complications in the ICU is very critical. As pregnant women with COVID-19 have higher rates of preeclampsia, and HELLP syndrome.[18,19] Therefore, the involvement of a multidisciplinary team that includes maternal-fetal medicine, obstetric, neonatal, and medical intensive care teams can be the best approach to improve patients' outcomes.[20]

Study limitations. First, our study was only carried out in a single center; thus, we cannot generalize our findings to all pregnant ICU COVID-19 patients. Second, further research involving multiple centers for a larger sample size is vital to provide more reliable results. Third, our study has a retrospective design and descriptive nature, making it prone to reporting bias. Lastly, our data collection for our cohort was limited to the period covering the Delta and Omicron wave of the pandemic, consequently our results cannot be generalized to emerging COVID-19 variants.

In conclusion, this study spotlights the traits of pregnant women admitted to the ICU in a specialized tertiary healthcare hub in Saudi Arabia. Our findings indicate that the patients were primarily young and healthy. The APACHI IV score in our group accurately predicted patient mortality and correlated with the length of ICU stay and the duration of MV. Our findings underline the need for specific interventions and recommendations for pregnant women in the ICU affected by COVID-19.

Acknowledgment. *The authors gratefully acknowledge American Manuscript Editors for English language editing.*

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