# METABOLIC SYNDROME AND CLINICAL OUTCOMES IN A SAMPLE OF EGYPTIAN PATIENTS INFECTED WITH COVID-19

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## ABSTRACT:

*Obesity, diabetes, and hypertension are the three main components of the metabolic syndrome and risk factors for developing severe COVID-19 infection. The pro-inflammatory state of metabolic syndrome may be responsible for associated complications of COVID-19.*

***Methodology**: We conducted a retrospective cross-sectional study in Ain Shams University Isolation Hospital. A total number of 101 patients were recruited during the period from June 2021 to December 2021 , and they were divided into two groups based on whether they had the metabolic syndrome or not.*

***Results:** The majority of the admitted patients with COVID-19 were obese class I with mean = 34.72 kg/m2, and 57.4% of them were males.*

*59.6% of patients with metabolic syndrome had hypoxia in comparison to 38.9% of non metabolic syndrome patients who had hypoxia. They were also more vulnerable for admission in ICU than non metabolic syndrome patients , 38 (80.9%) vs 28 (51.9%) respectively.*

*We found also statistically significant difference between patients with metabolic syndrome and non metabolic syndrome patients regarding medications and the need to receive methyl prednisolone and tocilizumab to suppress the cytokine storm, (36.2% )versus (3.7 % ) , (21.3 %) versus ( 1.9 %),(p value =0.01 ) and (p value =0.02 ) respectively.*

***Conclusion:** Metabolic syndrome is a strong risk factor for hospitalization and morbidity in a global population of hospitalized patients with COVID-19.*

***Key words:** COVID-19 and Met S*

## INTRODUCTION:

One third of COVID-19 hospitalized patients develop severe pneumonia that necessitates admission in the intensive care unit (ICU)[(1)]. Obesity, prediabetes/diabetes, hypertension, hypertriglyceridemia, and low HDL levels are the five metabolic components that were used to define metabolic syndrome (MetS)[(2)].

MetS is considered a chronic low-grade inflammation, with high levels of circulating CRP, interleukin 6 (IL-6), and IL-1[(3)]. The development of macro vascular complications that significantly enhance morbidity and death is attributed to these systemic inflammatory mediators. [(4).]

## AIM OF THE WORK:

To study the link between metabolic syndrome and clinical outcomes in infected patients with COVID- 19.

## PATIENTS AND METHODS:

### Study design:

A retrospective cross sectional study of

101 hospitalized patients with COVID-19.

The patients were recruited from Ain Shams University isolation hospital (ward and intermediate care unit department) during the period from June 2021 to December 2021.

**Study population:**

**Inclusion criteria:** Patients with COVID-19 infection who were confirmed by positive PCR and typical HRCT chest abnormalities met the inclusion criteria.

Metabolic syndrome was defined according to modified WHO criteria.

Patients were diagnosed to have metabolic syndrome if at least three of the following five criteria were found: (1) Body mass index (BMI) ≥30 kg/m$^2$, (2) Fasting plasma glucose ≥100 mg/dl which was replaced by with HbA1c ≥ 5.7% as it reflects hyperglycemia independently of infection and stress, (or treatment for diabetes mellitus) (3) systolic blood pressure >130 mmHg or diastolic >85 mmHg (or receiving antihypertensive treatment). (4) serum TGs ≥150 mg/dL (or on treatment for elevated triglycerides), (5) HDL-C < 40 mg/dL in males or <50 mg/dL in females (or on treatment).

Any patient who was diagnosed with T1DM, T2DM, prediabetes or on treatment met this criterion.

Treatment included any oral antidiabetic drugs (metformin, sulfonylurea, SGLT2 inhibitor, GLP1 agonist, or DPP4 inhibitor) or insulin. The third criterion could be met if the patient is receiving antihypertensive treatment (angiotensin-converting enzyme (ACE) inhibitor, aldosterone receptor blocker, calcium channel blocker, or beta blocker).

When serum TG levels were not available, any lipid-lowering agent (statin, fibrate, ezetimibe, PCSK9 inhibitor, or bile acid resin) met the third criterion.

In absence of available lipid profiles for many admitted patients, we decided that all of patients with metabolic syndrome should meet the other 3 criteria or were receiving antihyperlipidemic medications plus presence of another 2 criteria .

Those who missed data on three or more criteria were excluded.

**Exclusion criteria:** Patients who had negative RT-PCR results for SARS-CoV-2 were excluded.

Patients who were pregnant, nursing or under the age of 18 had been excluded

**Study procedures**: In the present study all patients were subjected to full history taking, physical examination including: height, weight, waist circumference (WC), systolic , diastolic blood pressures (SBP and DBP)and laboratory investigation (including, PCR for COVID-19,Arterial blood gas (ABG), HbA1c, C-reactive protein (CRP), D-dimer, Ferritin, complete blood count including lymphocyte counts,ALT,AST, BUN, creatinine and lipid profile if available.

**Imaging**: including: HRCT chest.

Chest CT images had been noted for the following signs: GGO, consolidation, nodules, reticulation, linear opacities, interlobular septal thickening, crazy-paving pattern, sub pleural curvilinear lines, bronchial wall thickening, lymph node enlargement, pleural effusion, and pericardial effusion. Any further lung disease, such as emphysema, bronchiectasis, or tuberculosis, were individually noted. Finally, utilizing the Fleischner Society: Glossary of Terms for Thoracic Imaging (2008) as the primary reference tool to identify the lesions, the site, distribution, laterality, pattern, and prevalence of the pulmonary lesions are evaluated[(5)].

A scoring system was used to assess the percentage of lobar involvement and the overall total CT severity score of the lung. Each of the five lobes of the lung was

evaluated and classified as 0=no lobe involvement (0%), 1=minimal involvement (1–25%), 2=mild involvement (26–50%), 3=moderate involvement (51–75%), and 4=severe involvement (76–100%). The total CT severity score is the sum of scores of all lobes ranging from 0 to 20. The severity of lung affection was classified on a four-point ordinal scale: grade 0 score of 0 (normal CT), grade 1 score of 1–5 (mild degree), grade 2 score of 6–15 (moderate degree), and grade 3 score of 16–20 (severe degree)[6].

**Ethical Consideration**:

An approval of the study had been taken from Ain Shams University Academic and Ethical Committee.

All of the studied data were gathered as a part of standard medical diagnosis and care.

An approval of the study had been taken from Ain Shams University Academic and Ethical Committee.

**Statistical Analysis:**

Data were analyzed using IBM© statistics version 23 (IBM© Corp., Armonk, NY) and MedCalc © version 18.2.1 (MedCalc © Software bvba, Ostend, Belgium). Continuous numerical variables were presented as mean and SD and inter-group differences were compared using the unpaired t-test. Categorical variables were presented as number and percentage and differences were compared using Chi2 test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: P-value > 0.05: Non significant (NS), P-value < 0.05: Significant (S), P-value < 0.01: Highly significant (HS).

**RESULTS:**

**On reviewing the Clinical features of Admitted patients underwent this study**:

We found that their mean age was 44.94 ± 11.79 years old , 58 (57.4%) were males while 43 (42.6%) were females.

Mean BMI was 34.72 ± 6.69 kg/m2 which means that the majority of admitted patients had class I obesity .

46(45.5%) were diabetic, 40(39.6%) were hypertensive and 37 (36.6%) had history of dyslipidemia.

**On comparing the Metabolic syndrome group (n=47) and non metabolic syndrome group (n=54):**

47 patients had metabolic syndrome while 54 were non metabolic syndrome patients.

On comparing the individual components of metabolic syndrome in both groups (Metabolic syndrome patients vs non metabolic syndrome patients), we found that diabetes affected 34 (72.3%) in the metabolic syndrome group vs 12(23.5%) in the non metabolic syndrome group, prediabetes involved 12 (25.5%) in metabolic syndrome group vs 4 (7.5 %) in the non metabolic syndrome group.

Hypertension affected 31 (66 %) in metabolic syndrome group vs 9 (16.7 %) in the non metabolic syndrome group and 31 (66 %)had history dyslipidemia in the metabolic syndrome group vs 6 (11.2 %) in the other group.

Regarding age, sex, ALT, AST, TLC, Hemoglobin, Ferritin, CRP, D DIMER, there were no statistically significant difference between the studied groups (p-value >0.05). (Table 1,2). But regarding BMI there was a high statistically difference (p-value < 0.01), between the studied groups being higher in Metabolic syndrome patients (38.55 ± 6.28 $kg/m_2$) than non metabolic syndrome patients (31.39 ± 5.09 $kg/m_2$) (Table 1), and Hba1c was also significantly higher in metabolic syndrome patients (7.76 ± 1.31%) than non metabolic syndrome patients (5.65 ± 1.05%), (p-value <0.01).

Also, Regarding $O_2$ Saturation there was

statistically significant difference between the studied groups (p-value <0.05), being (59.6%) of patients with metabolic syndrome had hypoxia while (38.9%)of non metabolic syndrome patients had hypoxia.(Table 3) In addition, we found interestingly statistically significant difference between patients with metabolic syndrome and non metabolic syndrome patients regarding the need to receive tocilizumab, hydrochloroquine ,and methylprednisolone (21.3%) vs (1.9%), (38.3%) vs (5.6%), and (36.2%) vs (3.7%) , (p-value <0.05) respectively. (Table 4)

And lastly on comparing the two groups regarding CT chest finding ,we found there was highly significant difference between both groups as the patients with metabolic syndrome had more chance to develop crazy paving lesions,11 (23.4%) vs 2 (3.7%), and had higher HRCT score than non metabolic syndrome patients ; median IQR= 18 (14 – 23) versus 16 (7 – 17) which indicates more severe lung infiltration(p-value <0.01).

Table (1): Clinical features and Investigations of Admitted patients underwent this study

| | | Total no. = 101 |
|---|---|---|
| Age (years) | Mean ± SD | 44.94 ± 11.79 |
| | Range | 20 – 79 |
| Gender | Male | 58 (57.4%) |
| | Female | 43 (42.6%) |
| BMI (kg/m2) | Mean ± SD<br>Range | 34.72 ± 6.69<br>23 – 50 |
| D.M | No<br>Yes | 55 (54.4%)<br>46(45.6%) |
| Pre D.M | No<br>Yes | 85 (81.1%)<br>16(15.9%) |
| Hypertension | No<br>Yes | 61 (60.3%)<br>40(39.7%) |
| History of hyperlipidemia/ received statins or fibrates | No<br>Yes | 64 (63.3%)<br>37 (36.7%) |
| Hematocrit | Mean ± SD<br>Range | 39.65 ± 5.21<br>17.8 – 49 |
| Hemoglobin g/dl | Mean ± SD<br>Range | 13.11 ± 1.75<br>8 – 17.8 |
| TLC ( x10 ^ 9/L) | Median (IQR)<br>Range | 5.5 (3.7 – 7.3)<br>1.6 – 11.9 |
| Lymphocytes (x10 ^ 9/L0 | Median (IQR)<br>Range | 1.7 (1.1 – 2.18)<br>0.14 – 4.6 |
| ALT(u/l) | Median (IQR)<br>Range | 12 (10 – 15)<br>8 – 30 |
| AST(u/l) | Median (IQR)<br>Range | 24 (20 – 30)<br>14 – 40 |
| Creat(mg/dl) | Median (IQR)<br>Range | 0.9 (0.7 – 1.2)<br>0.4 – 2.2 |
| BUN(mg/dl) | Median (IQR)<br>Range | 15 (9 – 23)<br>7 – 33 |
| Ferritin(0-300ng/ml) | Median (IQR)<br>Range | 135 (65 – 344)<br>20 – 972 |
| CRP(mg/l) | Median (IQR)<br>Range | 0.74 (0.44 – 1.43)<br>0.07 – 13.5 |
| D-dimer (mg/l) | Median (IQR)<br>Range | 0.28 (0.17 – 0.55)<br>0.03 – 2.3 |
| HbA1C (%) | Mean ± SD | 6.63 ± 1.58 |

*BMI, Body Mass Index;D.M,Diabetes Mellitus; Pre D.M, Pre Diabetes Mellitus; TLC, total lecocytic count;* ALT , alanin aminotransferase;AST, aspartat aminotransferase, *Creat,creatinine; BUN, blood urea nitrogen.*

Table (2): Comparison between metabolic syndrome patients and non -metabolic syndrome admitted patient regarding Clinical feature and Investigations.

| | | Metabolic Syndrome | Non metabolic syndrome | Test value | P-value | Sig. |
|---|---|---|---|---|---|---|
| | | No. = 47 | No. = 54 | | | |
| Age (years) | Mean | 46.98 ± 9.86 | 43.17± 11.98 | 1.6 | 0.1 | NS |
| Gender | Male<br>female | 25 (53.1 %)<br>22 (46.9 %) | 33 (61.1 %)<br>21 (38.9 %) | 0.56 | 0.6 | NS |
| D.M | No<br>Yes | 13 (27.7%)<br>34 (72.3%) | 42 (77.7%)<br>12(23.5%) | 18.4 | 0.01 | HS |
| Pre D.M | No<br>Yes | 35 (74.5%)<br>12 (25.5%) | 50 (92.5 %)<br>4 (7.5 %) | 6.1 | 0.12 | S |
| Hypertension | No<br>Yes | 16 (34 %)<br>31 (66 %) | 45 (83.3 %)<br>9 (16.7 %) | 25.5 | 0.01 | HS |
| History of hyperlipidemia | No<br>Yes | 16 (34 %)<br>31 (66 %) | 48 (88.8 %)<br>6 (11.2 %) | 32.5 | 0.01 | HS |
| BMI(kg/m2) | Mean ± SD | 38.55 ± 6.28 | 31.39 ± 5.09 | -6.328• | 0.01 | HS |
| | Range | 23 – 50 | 23 – 45 | | | |
| Hemoglobin g/dl | Mean ± SD | 13.07 ± 1.81 | 13.15 ± 1.71 | 0.235• | 0.815 | NS |
| | Range | 8.2 – 17.8 | 8 – 16.3 | | | |
| Hematocrit % | Mean ± SD | 38.73 ± 5.81 | 40.45 ± 4.54 | 1.667• | 0.099 | NS |
| | Range | 17.8 – 49 | 27.5 – 49 | | | |
| TLC (x10 ^ 9/L) | Median (IQR) | 5.8 (4.2 – 7.3) | 4.65 (3.58 – 7) | -1.692≠ | 0.091 | NS |
| | Range | 2.2 – 10 | 1.6 – 11.9 | | | |
| Lymphocytes (x10 ^ 9/L) | Median (IQR) | 1.9 (1.3 – 2.2) | 1.55 (0.8 – 2.1) | -1.902≠ | 0.057 | NS |
| | Range | 0.6 – 3.5 | 0.14 – 4.6 | | | |
| ALT(u/l) | Median (IQR) | 12 (11 – 15) | 12 (10 – 13) | -1.192≠ | 0.233 | NS |
| | Range | 9 – 20 | 8 – 30 | | | |
| AST(u/l) | Median (IQR) | 25 (20 – 30) | 23.5 (20 – 30) | -0.659≠ | 0.510 | NS |
| | Range | 18 – 40 | 14 – 40 | | | |
| Create(mg/dl) | Median (IQR) | 1.2 (0.8 – 1.4) | 0.8 (0.7 – 0.9) | -4.221≠ | 0.01 | HS |
| | Range | 0.5 – 2.2 | 0.4 – 1.3 | | | |
| BUN(mg/dl) | Median (IQR) | 22 (15 – 25) | 10 (9 – 15) | -5.364≠ | 0.01 | HS |
| | Range | 7 – 33 | 7 – 25 | | | |
| Ferritin(0-300ng/ml) | Median (IQR) | 130 (58 – 321) | 137.5 (75 – 376) | -0.803≠ | 0.422 | NS |
| | Range | 26 – 972 | 20 – 899 | | | |
| CRP(mg/l) | Median (IQR) | 0.66 (0.4 – 1.2) | 0.8 (0.58 – 1.8) | -1.096≠ | 0.273 | NS |
| | Range | 0.07 – 8.2 | 0.07 – 13.5 | | | |
| D-dimer(mg/l) | Median (IQR) | 0.3 (0.18 – 0.56) | 0.28 (0.13 – 0.55) | -0.667≠ | 0.504 | NS |
| | Range | 0.06 – 2.3 | 0.03 – 2.3 | | | |
| HbA1C (%) | Mean ± SD | 7.76 ± 1.31 | 5.65 ± 1.05 | -9.016• | 0.01 | HS |
| | Range | 5.5 – 9.9 | 4.8 – 9.6 | | | |

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant

•: Independent t-test; ≠: Mann-Whitney test . *BMI,Body Mass Index;D.M,Diabetes Mellitus;Pre D.M, Pre Diabetes Mellitus;TLC,total lecocytic count;* ALT, alanin aminotransferase*;*AST, aspartate minotransferase, *Creat, creatinine; BUN, blood urea nitrogen.*

Table (3): Comparison between metabolic syndrome patients and non -metabolic syndrome regarding oxygen status, HRCT score and ICU admission

| | | Metabolic Syndrome | Non metabolic syndrome | Test value | P-value | Sig. |
|---|---|---|---|---|---|---|
| | | No. = 47 | No. = 54 | | | |
| Hypoxia | No | 19 (40.4%) | 33 (61.1%) | 4.305* | 0.038 | S |
| | Yes | 28 (59.6%) | 21 (38.9%) | | | |
| HRCT | Bilateral | 46 (97.9%) | 52 (96.3%) | 0.217* | 0.642 | NS |
| | Unilateral | 1 (2.1%) | 2 (3.7%) | 0.217* | 0.642 | NS |
| | Subpleural | 34 (72.3%) | 45 (83.3%) | 1.782* | 0.182 | NS |
| | Lower lobe | 46 (97.9%) | 54 (100.0%) | 1.160* | 0.281 | NS |
| | Upper lobe | 30 (63.8%) | 27 (50.0%) | 1.955* | 0.162 | NS |
| | Consolidation | 10 (21.3%) | 13 (24.1%) | 0.112* | 0.738 | NS |
| | Crazy paving | 11 (23.4%) | 2 (3.7%) | 8.696* | 0.01 | HS |
| HRCT score on admission | Median (IQR) | 18 (14 – 23) | 16 (7 – 17) | -3.292≠ | 0.01 | HS |
| | Range | 5 – 25 | 4 – 24 | | | |
| Ground glass on admission | No | 10 (21.3%) | 1 (1.9%) | 9.770* | 0.002 | HS |
| | Yes | 37 (78.7%) | 53 (98.1%) | | | |
| ICU admission | No | 9 (19.1%) | 26 (48.1%) | 9.332* | 0.002 | HS |
| | Yes | 38 (80.9%) | 28 (51.9%) | | | |

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
*: Chi-square test; ≠: Mann-Whitney test *HRCT, High resolution computed tomography.*

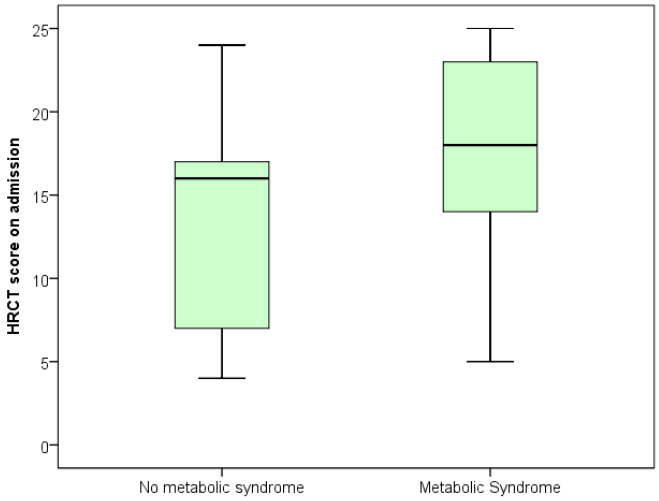


Figure (1): Comparison between non metabolic syndrome patients and metabolic syndrome patients regarding HRCT score on admission

Table (4): Comparison between metabolic syndrome patients and non -metabolic syndrome patients regarding medications

| Treatment | Metabolic Syndrome | Non metabolic syndrome | Test value | P-value | Sig. |
|---|---|---|---|---|---|
| | No. = 47 | No. = 54 | | | |
| Vitamin C | 47 (100.0%) | 53 (98.1%) | 0.879* | 0.348 | NS |
| Levofloxacin | 46 (97.9%) | 53 (98.1%) | 0.010* | 0.921 | NS |
| Enoxaparin | 46 (97.9%) | 48 (88.9%) | 3.144* | 0.076 | NS |
| Prednisolone | 29 (61.7%) | 50 (92.6%) | 14.074* | 0.001 | HS |
| Azithromycin | 20 (42.6%) | 24 (44.4%) | 0.037* | 0.848 | NS |

| | | | | | |
|---|---|---|---|---|---|
| Hydroquinone | 18 (38.3%) | 3 (5.6%) | 16.358* | 0.001 | HS |
| Methylprednisolone | 17 (36.2%) | 2 (3.7%) | 17.343* | 0.001 | HS |
| Tocilizumab | 10 (21.3%) | 1 (1.9%) | 9.770* | 0.002 | HS |
| Other oral Anticoagulants | 1 (2.1%) | 6 (11.1%) | 3.144* | 0.076 | NS |
| Meropeniem | 0 (0.0%) | 1 (1.9%) | 0.879* | 0.348 | NS |

P-value > 0.05: Non significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
*: Chi-square test

## DISCUSSION:

Coronavirus disease (COVID-19) was first identified in Hubei, China, in December 2019[7]. Rapid disease spread has caused major economic and health burden across the world so the World Health Organization declared COVID-19 a global pandemic in March 2020 [8].

COVID-19 infection typically causes severe pneumonia and acute respiratory distress syndrome necessitating hospitalization in the critical care unit and may need invasive mechanical ventilation. In critically ill COVID 19 patients, pro-inflammatory cytokines and inflammatory markers are enhanced and lead to cytokine storm which exacerbates the illness, and may cause sepsis and multiorgan failure [9].

Insulin resistance, hypertension, and central obesity are the main elements of the metabolic syndrome (MetS), which can result in myocardial and endothelial damage as well as other cardiovascular events mainly due to metabolic active visceral adipose tissue which secretes proinflammatory cyto-kines[10].

The role of metabolic syndrome in the risk and severity of COVID-19 infection has been thoroughly researched in many population studies, it was connected to severe and fatal COVID-19 complications.[11]

Our cross sectional study was aiming to study the relationship between Metabolic syndrome and COVID .It was conducted on 101 subjects, who were recruited from Ain Shams Isolation University Hospitals ( ward and intermediate care unit department)during 6 months duration from June 2021 to December 2021 and were divided later into metabolic syndrome group and non metabolic syndrome group. Our current study showed that the majority of patients admitted with COVID-19 were obese class I with Mean ± SD 34.72 ± 6.69 kg/m2.

This result was in line with **Sattar et al.'s** findings in 2020, who discovered that the risk of Covid-19-related death was more strongly correlated with BMI, particularly for people aged 70 years or younger compared with older people, the majority of patients admitted with COVID-19 were obese class I with Mean SD 34.72 6.69 kg/m2. Obesity has always been acknowledged as a risk factor for viral infections because of its effect on immune response. [12] During the 2009 H1N1 outbreak, people who had obesity experienced more severe comorbidity and needed more care. According to research, a sizable percentage of obese adults have COVID-19-related complications that necessitate hospital admission. In a research conducted in New York City (NYC), 21% of the 3615 individuals who tested positive for COVID-19 had obesity, and 16% had a body mass index (BMI) > 35 kg/m2[13]. This was also consistent with the findings of **GAO et al**., who suggested that the risk of severe COVID-19 outcomes were attributable to excess weight (i.e., 23 kg/m2) which led to insulin resistance. This impairment of lung function from excess weight was possibly related to chronic inflammation, which disrupts immune and thrombogenic responses to pathogens. [14]. Also, we found that The Mean ± SD age was 44.94 ± 11.79 years old ,and the majority of them were males 58 (57.4%), in comparison to 43 (42.6%) females. This finding was in agreement with recent meta analysis which

found that COVID-19 was more severe in males and less severe in females because estradiol is more effective at preventing infectious diseases by enhancing T cell responses, increasing antibody production, somatic hyper-mutation, and class switching in women who may have a greater capacity to mount humoral immune responses than men. Estradiol also increases the number of neutrophils and the generation of monocyte/macrophage cytokines. [(15)].

In addition, Our results demonstrated that patients with metabolic syndrome are more vulnerable for developing severe pneumonia with higher HRCT score than non metabolic syndrome patients ; median IQR= 18 (14 – 23) versus 16 (7 – 17) (p-value <0.01).

They were also more prone to develop hypoxia than non metabolic syndrome patients, (59.6 % versus 38.9 %) and also more susceptible for ICU admission than non metabolic syndrome patients, (80.9 % versus 51.9 %) (p-value =0.002).

We found also was statistically significant difference between patients with metabolic syndrome and non metabolic syndrome patients regarding the need to receive methyl prednisolone and Tocilizumab to supressthe cytokine storm, (36.2% )versus (3.7 % ) , (21.3 %) versus ( 1.9 %),(p -value =0.01 ) and (p -value =0.02 ) respectively.

These findings are consistent with a meta-analysis of 75 studies conducted in 10 countries in Asia, North America, and Europe, which found that obese patients had a 74% higher COVID-19 admission rate and a 48% higher COVID-19 mortality rate than their normal-weight counterparts. This could be explained by the hypothesis that the metabolic syndrome causes chronic low-grade inflammation which plays a key role in predisposing individuals to ARDS and ultimately mortality [(16)].Our research supports this theory because it shows that individuals with metabolic syndrome had a higher probability of overall poor outcomes, including ARDS [(17)].

**Conclusion:**

Metabolic syndrome is a strong risk factor for increased hospitalization, morbidity in a global population of hospitalized patients with COVID-19.

**Limitations:**

- Because of the sample's relatively small size, it was difficult to identify any causal links between the outcomes and the metabolic syndrome surrogate indicators.

- Information bias due to the unavailability of some data from the medical records.

- Lipid profiles weren't available for many patients as they weren't routinely measured due to financial issues, so we excluded it from the study to avoid any information bias and depended mainly on the other 3 criteria.

**Recommendations**:

-Tight adjusting of blood glucose, blood pressure and weight loss which may decrease morbidity and mortality due to COVID-19.

- Further studies with larger populations are required.

-Further studies are needed to elucidate the potential biological mechanisms by which Covid-19 affecting diabetic patients.

**Conflict of Interest:**

No conflict of interest.

**List of abbreviations:**

| | |
|---|---|
| BMI | = Body mass index |
| D.M | = Diabetes mellitus |
| MetS | =Metabolic syndrome |
| TGs | = Triglycerides |
| HDL-C | = High density lipoprotein-cholesterol |
| T1DM | = Type 1 Diabetes mellitus |
| T2DM | = Type 2 Diabetes mellitus |
| SGLT2 | = sodium-glucose cotransporter-2 inhibitors |

GLP1 = Glucagon-like peptide 1
DPP4 = Dipeptidyl peptidase 4
TLC =Total leucocyte count
ALT = alanine aminotransferase
AST = aspartate aminotransferase
CRP = C –reactive protein
BUN = blood urea nitrogen
HRCT = High resolution computed tomography

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## متلازمة التمثيل الغذائي والنتائج السريرية في عينة من المرضى المصريين المصابين بـكوفيد ١٩

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**الخلفية الرئيسية:**المكونات الرئيسية لمتلازمة التمثيل الغذائي هي السمنة والسكري وارتفاع ضغط الدم التي تم تحديدها كعوامل خطر للإصابة بـكوفيد ١٠.

قد تسفر حالة لالتهابات في متلازمة التمثيل الغذائي مسؤولة عن نتائج أسوأ في المرضي المصابين بكوفيد ١٩.

**المنهجية:** أجريت دراستنا المقطعية بأثر رجعي في مستشفى العزل بجامعة عين شمس ، وأجريت على ١٠١ شخصًا تم تقسيمهم لاحقًا إلى مجموعتين ؛ مرضى متلازمة التمثيل الغذائي ومرضى متلازمة عدم التمثيل الغذائي.

**النتائج:** كان معظم المرضى الذين تم إدخالهم مصابين بفيروس كوفيد من فئة السمنة الأولى بمتوسط ± انحراف معياري6.69 ± 34.72 كجم / م ٢ ، ذكور (٥٧,٤٪) ، مقابل (٤٢,٦٪) إناث. وكان متوسط عمرهم ± انحراف معياري 11.79 ± 44.94 سنة.

كان المرضى الذين يعانون من متلازمة التمثيل الغذائي أكثر عرضة للإصابة بنقص الأكسجة (٥٩,٦ ٪) مقابل مرضى متلازمة غير التمثيل الغذائي (٣٨,٩ ٪) ، كما أنهم أكثر عرضة للقبول في وحدة العناية المركزة ٣٨ (٨٠,٩ ٪) مقابل ٢٨ (٥١,٩ ٪) في مرضى متلازمة غير الأيضية.

فيما يتعلق بالأدوية ، هناك فرق إحصائي كبير بين المرضى الذين يعانون من متلازمة التمثيل الغذائي ومرضى متلازمة غير الأيض فيما يتعلق بتلقي ميثيل بريدنيزولون وتوسيليزوماب بسبب عاصفة السيتوكين ، ١٧ (٣٦,٢٪) مقابل ٢ (٣,٧٪) و١٠ (٢١,٣٪) مقابل ١ (١,٩) ٪) والقيمة الاحتمالية (٠,٠٥) و (٠,٠٢) على التوالي.

**الخلاصة:** ترتبط متلازمة التمثيل الغذائي بزيادة الاعتلال بشكل ملحوظ في المرضى في المستشفى المصابين بـكوفيد ١٩.