Section: Medicine

Original Research Article

CORRELATION BETWEEN METABOLIC SYNDROME AND COVID-19 SEVERITY AND MORTALITY IN PATIENTS ADMITTED IN TERTIARY CARE CENTRE

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Abstract

Background: COVID 19 patients have underlying risk factors associated with poor outcome. The aim of this study to correlate metabolic syndrome with severity and mortality of covid-19 outcome. **Material & Methods:** A Retrospective study on 200 cases of RT-PCR confirmed COVID-19 patients admitted in a dedicated COVID hospital by consecutive sampling, from April 2021 to October 2021, at a tertiary health care centre. Patients above the age of 18 years, willing to take part in the study and known covid-19 positive patients were included in study. Patients below the age of 18 years, without metabolic syndrome and clinically ambiguous covid – 19 negative cases were excluded from study. The record of all the admitted cases in the study duration was analyzed according to the DIAGNOSTIC CRITERIA FOR METABOLIC SYNDROME. Patient's demographic, anthropometric, clinical characteristics were recorded and filled in the proforma. **Results:** Mean age in study population was 48.75 ± 13.55 years with age range of 18-88 year, 65% males and 56% of cases belonged to urban area with mean BMI in study group was 30.60 ± 5.11 kg/m2. 90% presented with fever followed by 81% with cough and 74% had dyspnoea. 112 (56%) patients had severe disease, followed by 66 (33%) cases had moderate disease and 22 (11%) cases had mild disease. In our study, 164(82%) cases were discharged and 36 (18%) cases were died. Our study shows that severity increases with age and the difference was found to be statistically significant. ($p<0.05$) mortality was higher in the >60 yr age and the difference was found to be statistically significant. ($p<0.05$) There was no association with gender and mortality. **Conclusion:** Hospitalized patients with metabolic syndrome are more prone to severe disease and have poorer outcomes including increased mortality.

INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative agent of corona virus-induced disease 19 (COVID-19) was first reported in December 2019, in Hubei Province, China, from where it spread rapidly to all over the Globe. COVID-19 was declared as a global pandemic in March 2020 by the world health organization (WHO). In India first case of COVID-19 infection was reported from Kerala, on January 30, 2020.[1]

COVID 19 patients have underlying risk factors associated with poor outcome including, advanced age, male gender and presence of co-morbidities including hypertension, diabetes, cardiovascular disease and cerebrovascular disease. The prevalence of obesity, diabetes, arterial hypertension, cardiovascular and cerebrovascular disease increasing worldwide. Visceral obesity, diabetes, dyslipidemia, and arterial hypertension on tend to cluster forming a syndrome that we call metabolic syndrome.[2]

Most widely used definition is the one developed by the NSE &ATPIII which defines metabolic syndrome as the presence of any 3 of the following 5 traits.[3]

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1. Abdominal obesity, defined as a waist circumference >102cm in men, >88cm in females.
2. Serum HDL < 40mg/dl in men and <50 mg/dl in women
3. Serum Triglycerides level >150mg/dl or on drug treatment for elevated triglycerides.
4. BP > 130/85 mmhg or on drug treatment for elevated BP.
5. Fasting plasma glucose > 100mg/dl or on drug treatment for elevated blood glucose.

COVID-19 could cause endothelial dysfunction and a hyper-coagulation state. This condition is intensified by hypoxia, which augments thrombosis by both increasing blood viscosity and hypoxia-inducible transcription factors (HIF). Consequently, these could lead to pulmonary embolism with occlusion and micro-thrombosis in pulmonary vessels, as detected in critically ill COVID-19 patients. It is also reported that COVID-19 is associated with increased incidence of coagulation as well as thrombotic and inflammatory events, which was responsible, at least in part, for the severe morbidity and mortality. This suggests that COVID-19 activates yet another unidentified mechanism, which is involved in the coagulation process. Interestingly, it is well established that diabetes is a state of increased coagulability, where increased plasminogen activator inhibitor-1 is a consistent finding in patients with diabetes. Thus, increased coagulability in diabetes may be a possible mechanism that links diabetes to severity of COVID-19. The aim of this study to correlate the metabolic syndrome with severity and mortality of covid-19 outcome.

MATERIALS AND METHODS

A Retrospective study on 200 cases of RT-PCR confirmed COVID-19 patients admitted in a dedicated COVID hospital by consecutive sampling, from April 2021 to October 2021, at a tertiary health care centre, SP Medical College, Bikaner. Patients above the age of 18 years willing to take part in the study and known covid-19 positive patients were included in study.

Diagnostic Criteria for Metabolic Syndrome (NCEP ATP 3 Guidelines and Harmonising Definition Criteria)

(National Cholesterol Education Program, Adult Treatment Panel 3)

Metabolic syndrome is present if three or more of the following five criteria are met.

- High serum triglyceride (≥150mg/dl) or specific medication
- Low serum HDL cholesterol <40mg/dL in men and <50mg/dL in women or use of specific medication
- Blood pressure ≥130mmHg systolic or ≥85mmHg diastolic or specific medication
- Fasting plasma glucose ≥100mg/dL or specific medication or previously diagnosed type II diabetes
- Waist circumference ≥102 cm in men and ≥88 cm in women.

Patients below the age of 18 years, without metabolic syndrome and clinically ambiguous covid – 19 negative cases were excluded from study.

The study was approved by the institutional review board and informed consent was obtained by all patients prior to study entry. The record of all the admitted cases in the study duration was analyzed according to the Diagnostic Criteria for Metabolic Syndrome and 200 patients were found to have metabolic syndrome were included in study. Patient's demographic, anthropometric, clinical characteristics were recorded and filled in the proforma.

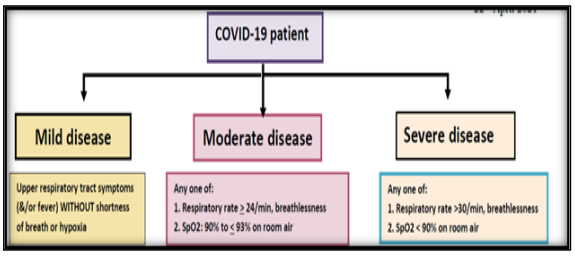

Figure 1: Clinical guidance for management of adult covid-19 patients

Waist Circumference was taken halfway between the iliac crest and lower rib margin, over light clothing, using an un-stretched tape meter without any pressure to the body surface, and was recorded to the nearest 0.1 cm. Blood pressure (BP) was measured twice in the right arm of subjects who had been resting for at least 5 minutes in a seated position using a mercury sphygmomanometer. Lipid Profile was determined using autoanalyser. FPG was measured using the glucose oxidase method. CBC, RFT and LFT were measured by autoanalyser.

Statistical Analysis

Data thus collected was entered in Microsoft excel 2007 and appropriate statistical tests were applied using appropriate software, considering p value <0.05 as statistically significant.

RESULTS

Majority of cases in study group belonged to age group 41-60 years (55%) while least cases belonged to age group >80 years (2%). Mean age in study population was 48.75 ± 13.55 years with age range of 18-88 year. In our study 65% males and 35% were female. 56% of cases belonged to urban area and 44% were at rural area. Mean BMI in study group was 30.60 ± 5.11 kg/m2.

In study group, 66% were on oral hypoglycemic agents followed by 54% on anti-hypertensive drugs and 56% were on statin therapy whereas minimum 48 cases (24%) were on insulin. 82.31% of male

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cases in study group had their waist circumference ≥102 cm with mean waist circumference of 108.45± 10.80 cm. 75.71% of female cases in study group had their waist circumference ≥88 cm with Mean waist circumference of 96.87 ± 10.69 cm. 128 (64%) cases of study group had their systolic blood pressure ≥130 mmHg and 126 (68%) cases of study group had their diastolic blood pressure ≥85 mmHg. Mean systolic blood pressure in study group was 136.32 ± 9.90 mmHg and Mean diastolic blood pressure in study group was 87.97 ± 6.22 mmHg. In present study, 75 (37.5%) cases of study group had their HDL cholesterol <40 mg/dL in males whereas 43 (21.5%) cases had their HDL cholesterol <50 mg/dl. Mean HDL cholesterol in study group was 42.28 ± 7.72 mg/dL. In our study 55 (27.5%) cases had their total cholesterol level >150 mg/dL. Mean triglyceride in study group was 138.74 ± 98.40 mg/dL. In study group, majority of cases 59.5% had their fasting blood sugar ≥126 mg/dL, while 28.5% cases had their fasting blood sugar in 100 - 125 mg/dL whereas minimum 24 (12%) cases had their blood sugar <100 mg/dl. Mean fasting blood sugar in study group was 150.39 ± 26.96 mg/dL.

In our study, maximum 90% presented with fever followed by 81% with cough and 74% had dyspnoea whereas minimum 16% had gastrointestinal symptoms followed by 24% had mayelgia.

In our study maximum cases 112 (56%) had severe disease, followed by 66 (33%) cases had moderate disease and 22 (11%) cases had mild disease.

In our study maximum 106(53%) cases needed o2 inhalation by NRBM followed by 50(25) cases were on nasal prong/ room air whereas minimum 44(22%) cases needed mechanical ventilation and 102(51%) cases were admitted to ICU and Mean length of hospital stay was 15.68 ±6.4 day.

In our study, 164(82%) cases were discharged and 36(18%) cases were died. 6 (17.14%) cases had severe disease in 21 – 40 yr age group, in 41 – 60 yr 58.18% cases were severe and in > 60 age group ¾ cases (76.36%) were with severe disease. Our study shows that severity increases with the age and the difference was found to be statistically significant ($p<0.05$).

In our study, in 21 – 40 yr age group 2 (5.71%) cases died, in age group 41 – 60 yr 19 (17.27%) cases were died and in age group > 60 yr 15 (27.27%) case died. mortality was higher in the >60 yr age and the difference was found to be statistically significant. ($p<0.05$) There was no association with gender and mortality.

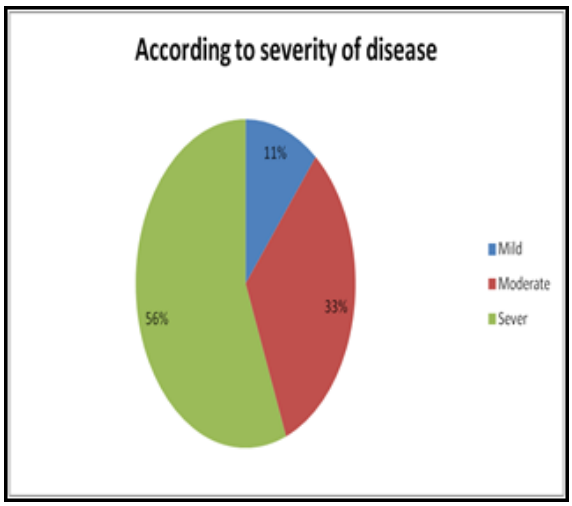

Figure 2: Patients according to severity of disease

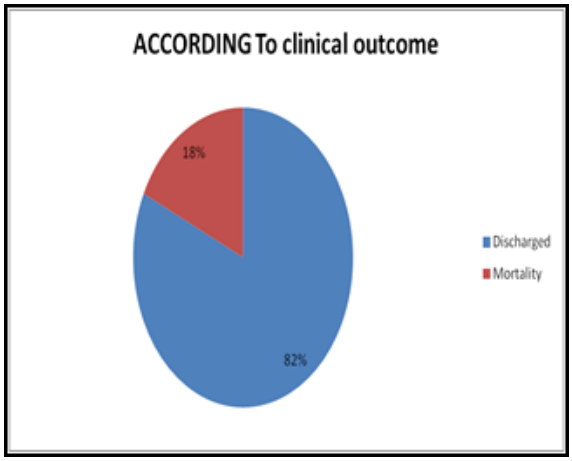

Figure 3: Patients according to outcome of covid- 19

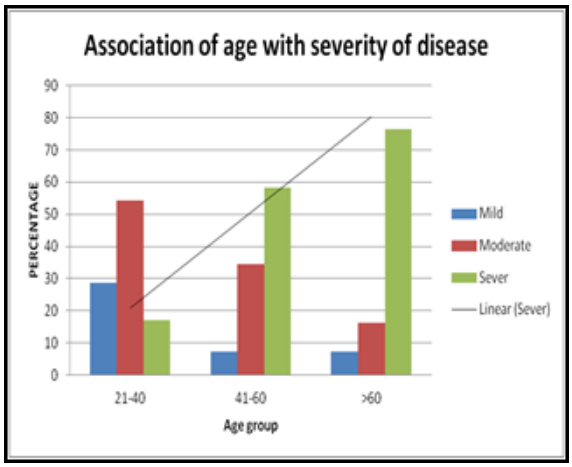

Figure 4: Patients according to correlation of age with severity

Table 1: Distribution of patients accordage to Socio-demographically

Age Group (Years)	No.	%
21 – 40	35	17.5
41 – 60	110	55
61- 80	51	25.5
>80	4	2
Mean	48.75 ± 12.65	
Gender		
Female	70	35
Male	130	65

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Residence		
Rural	88	44
Urban	112	56

Table 2: Components of metabolic syndrome

Components of metabolic syndrome		No.	%
Waist Circumference	male ≥102 cm (N=130)	107	82.31
	female ≥88 cm (N=70)	53	75.71
HDL Cholesterol (mg/dL)	male <40 mg/dL (N=130)	75	37.5
	female<50mg/dL (N=70)	43	21.5
Triglyceride ≥150 mg/dL		55	27.5
SBP ≥130 mmHg		128	64
DBP ≥85 mmHg		126	68
Fasting Blood Sugar (mg/dL)		150.39 ± 26.96	

Table 3: Symptoms of Covid

Symptoms	Frequency	Percent
Fever	180	90
Cough	162	81
Dyspnoea	148	74
GI symptoms	32	16
Myalgia	48	24

Table 4: Morbidity of Covid

O2 inhalation	Frequency	Percent
Nasal prongs/ Room air	50	25
NRBM	106	53
Mechanical Ventilation	44	22
ICU admission	102	51
Length of hospital stay	15.68 ±6.4	

DISCUSSION

In our study, majority of cases in study group belonged to age group 51-60 years (34.5%) followed by 41-50 years (16%) while least cases belonged to age group >80 years (2%). Mean age in study population was 48.75 ± 13.55 years with age range of 18-88 year. Similarly, Peña JE et al (2021),[4] found that more than half of the outpatients with COVID-19 are younger than 40 years, whereas the age distribution is shifted to older ages in hospitalized patients.

In present study, most of the patients were 65% males and 35% were female. Similarly, Narendran Gopalan et al. (2022),[5] found that among 746 COVID-19 patients hospitalized there was a slight male predilection 62.5%, (466/746).

In study group, 66% were on oral hypoglycemic agents followed by 54% on anti-hypertensive drugs and 56% were on statin therapy whereas minimum 48 cases (24%) were on insulin. Similarly, Hardeva Ram Nehara et al. (2022),[6] found that Diabetes mellitus (n=64, 20.4%) and hypertension (n=57, 18.2%) were the most common comorbidities, and 101 (32.2%) patients had ≥1 comorbidities.

Majority 82.31% of male cases in study group had their waist circumference ≥102 cm and 75.71% of female cases had their waist circumference ≥88 cm. Mean waist circumference in study group was 108.45± 10.80 cm in male and Mean waist circumference in study group was 96.87 ± 10.69 cm in females. Similarly, Teh-Ling Liou et al (2006)7 found that the metabolic syndrome was significantly associated with waist circumference (WC).

In the present study, 128 (64%) cases of study group had their systolic blood pressure ≥130 mmHg 126 (68%) cases of study group had their diastolic blood pressure ≥85 mmHg. Mean systolic blood pressure in study group was 136.32 ± 9.90 mmHg and mean diastolic blood pressure in study group was 87.97 ± 6.22 mmHg. Similarly, Peña JE et al (2021),[4] Hypertension was the more frequent comorbidity associated to COVID-19 in hospitalized patients. Also, Teh-Ling Liou et al (2006),[7] found that the metabolic syndrome was significantly associated with systolic BP.

In present study, 43 (21.5%) cases had their total cholesterol >200 mg/dl and mean total cholesterol in study group was 170.28 ± 47.72 mg/dL. In present study, 145 (72.5%) cases of study group had their triglyceride <150 mg/dL while 55 (27.5%) cases had their total cholesterol level >150 mg/dL. Mean triglyceride in study group was 138.74 ± 98.40 mg/dL. Also, Wiliane J. T. Marbou et al (2019),[8] found that hyper triglyceridemia (53.97%) was significantly associated with metabolic syndrome ($p<0.001$)

In study group, majority of cases 59.5% had their fasting blood sugar ≥126 mg/dL, while 28.5% cases had their fasting blood sugar in 100 - 125 mg/dL whereas minimum 24 (12%) cases had their blood sugar <100 mg/dl. Mean fasting blood sugar in the study group was 150.39 ± 26.96 mg/dL. Also, Teh-Ling Liou et al (2006)7 found that the metabolic syndrome was significantly associated with glucose level.

In our study, a maximum of 90% presented with fever followed by 81% with cough and 74% had

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dyspnoea whereas minimum 16% had gastrointestinal symptoms followed by 24% had myalgia. Similarly results found by Narendran Gopalan et al. (2022),[5] the distribution of symptoms among patients was as follows; fever—62.6% (455/727), breathlessness 49.9% (363/727), cough 46.4% (337/727), and gastrointestinal symptoms- 10.9% (79/727) in the decreasing order of frequency. Asymptomatic patients accounted for 6.7% (49/727).

In our study maximum cases 112 (56%) had severe disease, followed by 66 (33%) cases had moderate disease and 22 (11%) cases had mild disease. Similarly Ambrish Mithal et al. (2020),[9] found that majority (n = 381, 95%) of patients had mild disease and 17 (4.2%) patients were asymptomatic and severe disease was present in 20 (5%) patients at the time of admission in the hospital.

In our study maximum 106(53%) cases needed o2 inhalation by NRBM followed by 50(25) cases were on nasal prong/ room air whereas minimum 44(22%) cases needed mechanical ventilation. Ambrish Mithal et al. (2020)9 found that no oxygen requirement (n = 309, 77.1%) and or low flow oxygen requirement (n = 72, 18%) high flow oxygen-18, intubation, and intubation þ other organ support in one each.

In our study maximum 102(51%) cases were admitted to ICU whereas minimum 98(49%) cases had no need of ICU admission. Similarly, Shannon Wu et al. (2022),[10] found that 56% had ICU admission.

In our study, Maximum 110 (55%) cases were admitted for 1 to 2 weeks followed by 52 (26%) for >2 weeks whereas minimum 38 (19%) cases were admitted for <1 week. The mean length of hospital stay was 15.68 ±6.4 day. Ambrish Mithal et al. (2020)9 found that mean hospital stay was 9.1 ± 5.4 days.

In our study, 6 (17.14%) cases had severe disease in 21 – 40 yr age group, in age group 41 – 60 yr maximum 58.18% cases were severe and in age group > 60 ¾ cases (76.36%) were with severe disease. Our study shows that severity increases with the age and the difference was found to be statistically significant. (p<0.05)

In our study, 164(82%) cases were discharged, and 36(18%) cases were died. Similarly, Narendran Gopalan et al. (2022),[5] found that among 746 COVID-19 patients hospitalized 487 “survivors” and 259 “non-survivors” (deaths). Also Shannon Wu et al. (2022),[10] found that 81% for death (P < 0.001).

In our study, in 21 – 40 yr age group 2 (5.71%) cases died, in age group 41 – 60 yr 19 (17.27%) cases were died and in age group > 60 yr 15 (27.27%) case died. Our study shows that mortality was higher in the >60 yr age and the difference was found to be statistically significant (p<0.05). Similarly, Similarly Hardeva Ram Nehara et al. (2022)6 found higher death in age group ≥65 years compared to <65 years (P<0.001). Also, Peña JE et al (2021),[4] found that Case fatality rate increases with age, so that over half of those affected subjects aged 70 or above die. Alsi Narendran Gopalan et al. (2022)5 observed that higher mortality rate among 40–70 years age group 59.1%, (441/746).

In our study 28 (21.54%) male and 8(11.43%) female were died. The difference was not statistically significant. (p>0.05) Similarly Peña JE et al (2021),[4] found that case fatality rate is higher in males (20.2%), than in females (13.0%).

CONCLUSION

Our study shows a higher death in hospitalized COVID-19 patients than previously reported. It also shows that hospitalized patients with metabolic syndrome are more prone to severe disease and have poorer outcomes including increased mortality. Unless serious efforts are taken to combat the epidemic of non-communicable diseases (NCD) which threatens to overwhelm countries like India, the battle to reduce the adverse outcomes of the COVID-19 pandemic will be incomplete. The pandemic offers us a unique opportunity to reboot chronic care/ NCD programs.

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