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Diabetes & Metabolic Syndrome: Clinical Research & Reviews 14 (2020) 1805–1807

Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews

journal homepage: www.elsevier.com/locate/dsx

Is excess weight a risk factor for the development of COVID 19 infection? A preliminary report from India

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ARTICLE INFO

Article history:
Received 1 September 2020
Received in revised form
4 September 2020
Accepted 8 September 2020

Keywords:
Obesity
COVID-19

ABSTRACT

Background and aim: This study explored the association between BMI and COVID-19 positive status in a tertiary care hospital from New Delhi.
Methods: Three hundred and seventy nine adult patients who presented to COVID-19 screening outpatient department of the hospital were interviewed over the phone regarding their body weight and height. The COVID-19 RT-PCR report of the patients was extracted from the hospital information system.
Results: The mean BMI and the prevalence of obesity was observed to be higher in individuals who were detected to be COVID-19 RT-PCR positive as compared to those who were negative. With every one-unit increment in BMI above 23 kg/m^2, the odds of being COVID-19 positive increased by 1.8 times among these patients.
Conclusion: The findings suggest a dose-response association between BMI and the odds of COVID-19 infection in individuals with excess weight.

1. Introduction

The association between obesity and COVID-19 is being explored by several investigators across the globe and newer insights are evolving every day with the generation of new evidence. Studies suggest that in comparison to COVID-19 patients with normal body weight, obese patients are more likely to be critically ill, require mechanical ventilator support, and suffer increased complications and high mortality [1].

While there is relatively good data to suggest that the course and prognosis of COVID-19 are poorer among obese patients, the association between obesity and risk of COVID-19 infection is not established conclusively. Studies using UK biobank data and certain other studies suggest that there could be an association between the two [2]. These studies have been criticised for recall bias and studying a small sample size. Besides, there is no study from India that has a different BMI cutoff definition for obesity than the western population.

We conducted this study to explore the association between BMI and COVID-19 positive status in a COVID-19 screening OPD at a tertiary care centre in India.

2. Methodology

This cross-sectional study was performed in an out-patient clinic at a tertiary care hospital in New Delhi between June 17 and July 3, 2020. The study protocol was approved by the Institute Ethics Committee and informed consent was obtained from the participants before their enrolment. Patients with clinical suspicion of COVID-19 infection underwent SARS CoV-2 RT-PCR testing according to the testing advisory issued by the Indian Council of Medical Research (ICMR), Version 5, dated May 18, 2020 [3]. Patients with age greater than or equal to 18 years giving consent to participate in the study were included in the study. They were interviewed telephonically and their height and weight were recorded. The RT-PCR report regarding COVID-19 was extracted from the hospital information system.

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https://doi.org/10.1016/j.dsx.2020.09.012
1871-4021/

Table 1
Distribution of patients according to BMI and their RT-PCR status (n = 379).

Parameter	COVID-19 (RTPCR) Negative (n = 253)	COVID-19 (RTPCR) Positive (n = 126)	Total (n = 379)
BMI(kg/m^2) (Mean ± SD)	22.6 ± 3.1	28.8 ± 3.1	24.7 ± 4.3
Normal weight, N (%)	135 (53.3)	2 (1.6)	117 (30.9)
Overweight, N (%)	76 (30.0)	5 (4.0)	81 (21.4)
Obese I, N (%)	36 (14.3)	74 (57.4)	110 (29.0)
Obese II, N (%)	6 (2.4)	45 (36.0)	51 (13.4)
p-value (chi square test) < 0.001			

BMI values to define normal weight: 18.5–22.99 kg/m^2; Overweight: 23–24.99 kg/m^2; Obese I: 25–29.99 kg/m^2 and Obese II: ≥30 kg/m.^{2}.

Table 2
Logistic regression showing an association between BMI and a positive test for COVID-19.

Weight category according to BMI (kg/m^2)	Unadjusted OR (95% CI)	p-value	Adjusted OR for age (95% CI)	p-value	Adjusted OR for gender (95% CI)	p-value	Adjusted OR for both age and gender (95% CI)	p-value
Odds ratio with increase in one unit BMI	2.0 (1.7–2.3)	<0.001	2.0 (1.7–2.3)	<0.001	2.0 (1.7–2.3)	<0.001	2.0 (1.7–2.3)	<0.001
<23	1.0		1.0		1.0		1.0	
23–24.99	4.4 (0.8–23.4)	0.08	4.74 (0.89–25.2)	0.06	4.39 (0.83–23.3)	0.08	4.66 (0.87–24.7)	0.07
25–29.99	138.8 (32.5–592.6)	<0.001	168.1 (38.2–738.3)	<0.001	138.0 (32.3–589.0)	<0.001	166.8 (38.0–732.7)	<0.001
≥30	506.3 (98.6–2598.0)	<0.001	571.3 (108.6–3004.5)	<0.001	505.2 (98.4–2592.9)	<0.001	568.2 (108.1–2987.4)	<0.001

Normal body weight and obesity were defined according to the cutoff meant of the southeast Asian population [4]. The BMI range was defined as follows: 18.5–22.99 kg/m^2 as normal weight; 23–24.99 kg/m^2 as overweight; 25–29.99 kg/m^2 as obese I and ≥30 kg/m^2 as obese II.

Chi-square test was used to determine the association between stages of bodyweight/obesity (normal weight, overweight, obesity I and obesity II) and COVID-19 positive result, and student t-test was used to find a relationship between BMI and COVID-19 positive result. Logistic regression analysis was performed to determine the odds ratios of different grades of obesity considering normal weight as the reference category.

3. Results

Three hundred and seventy-nine patients with clinical suspicion of COVID-19 were enrolled in the study. The mean ± SD age of the participants was 35.6 ± 11.5 years, 246 (65%) were males and 132 (35%) were females. The mean BMI± SD of 379 participants was 24.7 ± 4.3 kg/m^2 with a range from 15.5 to 41.9 kg/m^2. The distribution of patients according to BMI and their SARS CoV-2 RT-PCR status is summarized in Table 1.

The dose-response association between BMI and a positive test for COVID-19 in people with overweight, obesity (grade I) and obesity (grade II) are shown in Table 2.

4. Discussion

Several theories have been proposed to explain mechanistic association between excess weight and COVID-19. One such theory postulates that adipose tissue is more susceptible to viral infection due to high levels of ACE-2 receptors, possibly higher than that in alveoli, facilitates entry of COVID-19 virus into the cell. Thus, obese people experience higher viral loads due to prolonged and increased viral shedding from adipose tissues (that act as reservoir) [5]. Moreover, increased adipose tissue, particularly in the abdominal region, is associated with a proinflammatory milieu. This leads to excessive cytokine release during the course of illness in COVID-19 that partly explains poor outcome [6]. Besides, obesity is known to increase thrombotic risks, that may contribute to the widespread microvascular thrombosis in COVID-19 [7]. Apart from these biological mechanisms, it has also been found that obese people (because of the associated stigma) are reluctant to seek healthcare until the disease gets advanced leading to poor prognosis [8].

The findings of several studies suggest that obesity is an independent risk factor of protracted course and poor outcome in COVID-19. However, the evidence regarding obesity as a risk factor in the causation of COVID-19 remains inconclusive. Razeih et al., analysed UK biobank data to study the association of BMI with confirmed COVID-19 in white European (WE) and black and minority ethnic (BME) individuals and observed that BMI was associated with the increased risk of a positive test for COVID-19 [2]. The dose-response association was pronounced in the BME group in comparison to the WE group. Bhasin et al., in a cross-sectional study on patients hospitalized with moderate to severe COVID-19, found that patients with COVID-19 had higher mean BMI than patients without COVID-19 and this association was more pronounced among younger patients (age <50 years) [9].

In the present study we observed that BMI is an important risk factor for a positive result for COVID-19 infection among patients with clinical suspicion of COVID-19. With every one unit increment in BMI above 23 kg/m^2, the odds of COVID-19 increases by 1.8 times. There appears to have a dose-response association between BMI and a chance of positive result for COVID-19 test in people with overweight, obesity I and obesity II. The odds ratios in these groups are 4.4, 138.8, and 506.6 in comparison to the participants with normal weight.

This study has certain limitations. The calculation for BMI is based on the height and weight values self-reported by the patients on recall, hence liable to be influenced by recall bias. The wide confidence interval of the odds ratios indicates inadequate sample size. Nevertheless, the findings of the study make way for a larger study with an appropriate sample size and robust methodology. Furthermore, lack of data on waist circumference and biochemical investigations like blood glucose, lipid profile etc. and their association with the course and prognosis, is a limitation of the study which needs to be evaluated in further studies. All the patients presented with mild symptoms and did not have any clinical evidence of pneumonia.

Funding

The AIIMS virology laboratory is funded and supported by the Department of Health Research/Indian Council of Medical Research as a Regional Viral Research Diagnostic Laboratory (R-VRDL) in their network.

Ethical concerns

Consent for case taken from patient.

Declaration of competing interest

None declared.

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