Obesity as a risk factor of COVID-19 severity: A literature review

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Abstract---Backgrounds: Patients with underlying comorbidities are more prone to contracting COVID-19 and developing severe and clinically deteriorating disease than patients without previous comorbidities. Obesity is a comorbid disease of COVID-19 with a high prevalence and is associated with the severity of COVID-19. This study aims to know about obesity as a risk factor of COVID-19 Severity. Methods/Design: This research method is literature review. The data bases used include Pubmed, DOAJ, and Wiley in the period 2016 until 2020. The keywords used in this article search is obesity, severity, and Covid-19. Based on the keywords used, 3,271 related articles were obtained. Based on the results of the article search process from various databases, 10 relevant articles were obtained. Conclusion: From the systematic review study obtained, it shows that obesity is a risk factor of COVID-19 severity.

Keywords---obesity, COVID-19, severity.

Introduction

COVID-19 is an infectious disease caused by the SARS-CoV-2 virus or better known as the Corona Virus. This virus consists of various types that can infect animals such as dogs and cats. (Bogoch et al., 2020; Lu et al., 2020). The outbreak of Covid-19 has had a detrimental effect on the global health care system and adverse effects on every aspect of human life.

Surveillance conducted by the Center for Disease Control (CDC) reported clinical data on 1,478 hospitalized patients who were confirmed positive for COVID-19 from March 1-30, 2020, indicating that the comorbidities with the highest prevalence were hypertension (49.7%), obesity (48 .3%), chronic lung disease (34.6%), diabetes mellitus (28.3%), cardiovascular disease (27.8%), neurological

disease (14%), and kidney disease (13%). An interesting trend from the data above is that obesity has a fairly high prevalence as a co-morbidity with COVID-19. From the data it is also known that COVID19 patients with obesity have a high prevalence at a young age, namely 18-49 years old (59%), 50-64 years old (49%), >65 years old (41%) (Garg S, 2020).

It is difficult to compare the impact of the COVID-19 pandemic across countries or across time as the number of reported cases and deaths can be strongly influenced by testing capacity and reporting policies. Excess mortality, defined as an increase in all-cause mortality relative to the recent average, is widely regarded as a more objective indicator of the COVID-19 mortality rate (Karlinsky & Kobak, 2021). Patients with underlying comorbidities are more prone to contracting COVID-19 and developing severe and clinically deteriorating disease than patients without previous comorbidities (Sanyaolu A, 2020).

Obesity is a comorbid disease of COVID-19 with a high prevalence and is associated with the severity of COVID-19. The extracellular domain of angiotensin converting enzyme (ACE)-2 has been identified as a receptor for the entry of the SARS-CoV-2 virus into the body. ACE-2 receptors are found in various body tissues such as the respiratory tract, heart muscle and kidney organs. The latest finding is that ACE-2 is also expressed in adipose tissue, so that in obese people it is found that an increase in ACE-2 expression makes it easier for the COVID-19 virus to enter and infect the body (Caci et all., 2020).

Obesity is associated with a decrease in the diversity of T cell receptors and causes a decrease in lymph node size, inhibition of the number of T cells in lymph nodes, and a reduced ability of the immune system to recognize foreign antigens (Woodall et al., 2020). Obese individuals exhibit high levels of leptin, a proinflammatory adipokine, and low concentrations of adiponectin, which is an antiinflammatory adipokine. This imbalance plays a role in modulating the immune system and contributes to complications in COVID-19 patients (Simonnet et al., 2020).

Method

This research method is systematic review. The databases used in this systematic review include Pubmed, DOAJ, and Wiley, which were published in the period 2016 until 2020. The keywords used in this article search were "obesity", AND "severity", AND "Covid-19". Based on the keywords used, 3,271 related articles were obtained. Another inclusion criteria is use english language, original research, and article is a research article in the form of full text.

Discussion

Database searches and hand-searching yielded 3,271 articles (see Fig. 1). After screening, 2856 were included in an abstract screening. The 2,858 articles that were eliminated because duplicate article, irrelevant or not answer the research question. From the systematic review study obtained, it shows that obesity can affect the severity of Covid-19.

Fig. 1 Systematic review selection flow chart
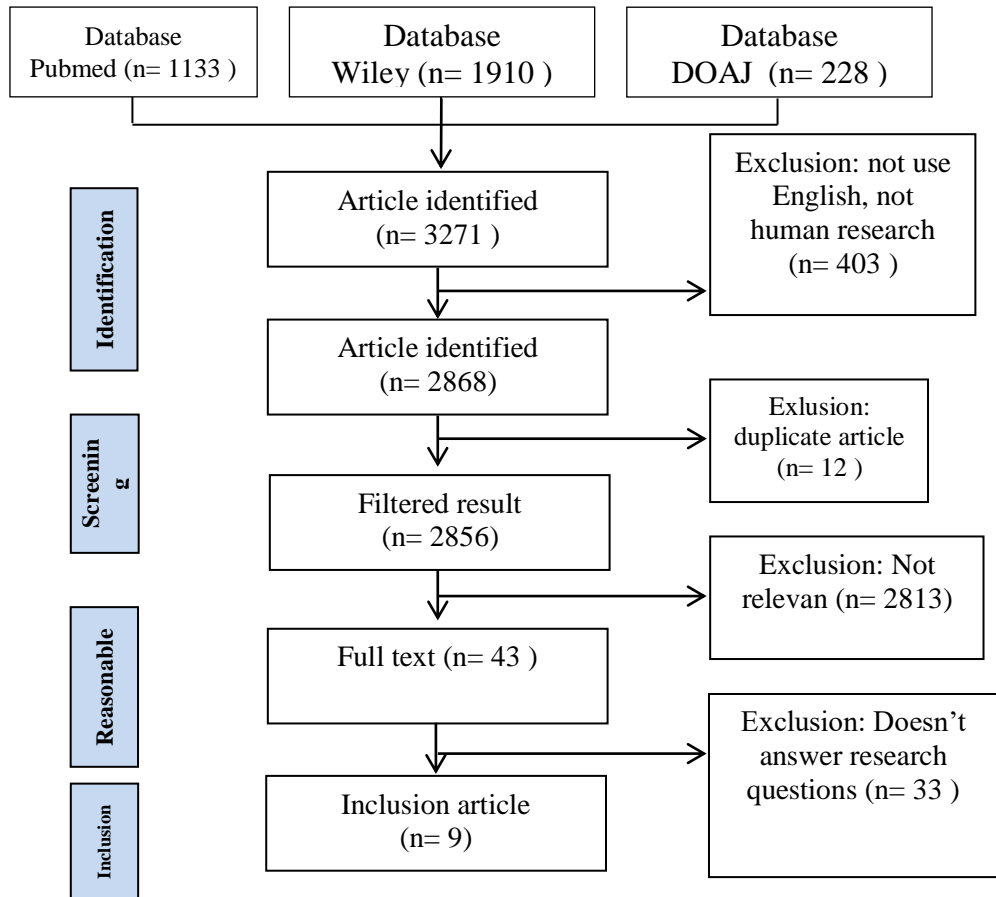
Compared with patients with normal weight, patients who were obese were at increased odds of progressing to severe disease, and the association remained significant after adjusting for comorbidities and other risk factors. Although the exact mechanism by which obesity may contribute to severe COVID-19 outcomes is not yet defined, several parameters may play a role (Kalligeros et al., 2020). In addition, further sub- analysis demonstrated that men with BMI ≥28 kg/m2 had more than threefold increased odds of progression to severe COVID-19, with almost half of the obese male patients developing severe COVID- 19. The association in women was less clear due to the small number of obese women in the study sample. Moreover, obese patients also tended to have typ- ical upper respiratory tract infection symptoms, such as fever and cough (Cai et al., 2020).

Table. 1 Descriptions of the selected studies

No	Author	Sample	Study design	Data analysis	Kesimpulan
1.	Qingxian Cai, Fengjuan Chen, Tao Wang,	383 patients	Case series study	Multivariate logistic regression	Obesity, especially in men,

	Fang Luo, Xiaohui Liu, Qikai Wu, Qing He, Zhaoqin Wang, Yingxia Liu, Lei Liu, Jun Chen, and Lin Xu				significantly increased the risk of developing severe COVID-19.
2.	Markos Kalligeros, Fadi Shehadeh, Evangelia K. Mylona, Gregorio Benitez, Curt G. Beckwith, Philip A. Chan, and Eleftherios Mylonakis	103 patients	Retrospective cohort	Multiple linear regression	Severe obesity (BMI ≥ 35 kg/m2) was associated with ICU admission, whereas history of heart disease and obesity (BMI ≥ 30 kg/m2) were independently associated with the use of IMV. Increased vigilance and aggressive treatment of patients with obesity and COVID-19 are warranted.
3.	Arthur Simonnet, Mikael Chetboun, Julien Poissy, Violeta Raverdy, Jerome Noulette, Alain Duhamel, Julien Labreuche, Daniel Mathieu, Francois Pattou, Merce Jourdain	124 patients	Retrospective cohort	Multivariate logistic regression	Obesity is a risk factor for SARS-CoV-2 severity requiring increased attention to preventive measures in susceptible individuals.
4.	Matteo Rottoli, Paolo Bernante, Angela Belvedere, Francesca Balsamo, Silvia Garelli, Maddalena Giannella, Alessandra	482 patients	Retrospective cohort	Multivariate logistic regression	Obesity is a strong, independent risk factor for respiratory failure, admission to the ICU and death among

					COVID-19 patients. A
	Cascavilla, Sara Tedeschi, Stefano Ianniruberto, Elena Rosselli Del Turco, Tommaso Tonetti, Vito Marco Ranieri, Gilberto Poggioli, Lamberto Manzoli, Uberto Pagotto, Pierluigi Viale and Michele Bartoletti				
5.	Feng Gao, Kenneth I. Zheng, Xiao-Bo Wang, Qing-Feng Sun, Ke-Hua Pan, Ting-Yao Wang, Yong-Ping Chen, Giovanni Targher, Christopher D. Byrne, Jacob George, Ming-Hua Zheng	75 patient	Retrospective cohort	Multivariate logistic regression	Obesity was associated with an approximately threefold increased risk of having severe COVID-19
6.	Ming Deng,Yongjian Qi,Liping Deng,Huawei Wang,Yancheng Xu,Zhen Li,Zhe Meng,Jun Tang,Zhe Dai	65 patient	Retrospective cohort	Multivariate logistic regression	Obesity is an important predictor of COVID-19 severity in young patients.
7.	Kenneth I. Zheng, Feng Gao, Xiao-Bo Wang, Qing-Feng Sun, Ke-Hua Pan, Ting-Yao Wang, Hong-Lei Ma, Yong-Ping Chen, Wen-Yue Liu, Jacob George, and Ming-Hua Zheng	214 patients	Retrospective cohort	Binary logistic regression	Obesity as a risk factor for greater severity of COVID-19.
8.	Salman Al-Sabah,Mohannad Al-Haddad,Sarah Al-Youha,Mohammad Jamal,Sulaiman Almazeedi	1,158 patuents	Retrospective cohort	Multivariate logistic regression	Patients with COVID-19 with underlying obesity or diabetes must be categorized

9.	David A Kass,a Priya Duggal,b and Oscar Cingolania	265 patients	Retrospective cohort	Multivariate linear regression	as a high-risk group
					Populations with a high prevalence of obesity, COVID-19 will affect younger populations more than previously reported.

Obesity can restrict ventilation by impeding diaphragm excursion, impairs immune responses to viral infection, is pro-inflammatory, and induces diabetes and oxidant stress to adversely affect cardiovascular function. Prediabetes has been identified as a relevant risk factor for significant comorbidities regardless of the BMI, such as cardiovascular and renal disease, and its role on the outcome of COVID-19 has yet to be assessed (Rottoli et al., 2020). A high frequency of obesity among patients admitted in intensive care for SARS-CoV-2. Disease severity increased with BMI. Obesity is a risk factor for SARS-CoV-2 severity requiring increased attention to preventive measures in susceptible individuals (Simonnet et al., 2020).

The presence of obesity was associated with an approximately threefold increased risk of having severe COVID-19 (Al-Sabah et al., 2020; Gao et al., 2020). Other study found that obesity is an important predictor of COVID-19 severity in young patients. The main mechanism is related to damage of the liver and kidney. In populations with a high prevalence of obesity, COVID-19 will affect younger populations more than previously reported (Deng et al., 2020; Kass et al., 2020). Study from Zheng et al., (2020) found that the risk of obesity to COVID-19 severity is greater in those with, than those without MAFLD (metabolic associated fatty liver disease).

Conclusion

In summary, obesity, an increasingly common chronic disease globally, was significantly associated with progression to severe COVID-19 in adults hospitalized with SARS-CoV-2 infection. As COVID-19 may continue to spread worldwide, clinicians should pay close attention to obese patients. Obese patients should be carefully monitored and managed with prompt and aggressive treatment.

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