



Bariatric Surgeries and COVID-19 Outcomes: More and More Benefits

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The rising prevalence of obesity has led to an increase in the evolution of bariatric surgeries. Several studies showed the superiority of bariatric surgeries compared to medical therapy in weight loss. In addition to its huge efficacy in weight loss, bariatric surgeries ameliorate several obesity-related complications like diabetes, hypertension, and dyslipidemia. Furthermore, several studies showed that bariatric surgeries were associated with a significant reduction in mortality [1]. The COVID-19 pandemic caused millions of deaths worldwide resulting in a public health emergency. In the absence of effective treatment, several risk and protective factors have been established to decrease the mortality of this disease. One of the contributing factors of COVID-19 severity is obesity as observational studies revealed that obese patients were more likely to die due to COVID-19 [2]. In addition, obesity can lead to several comorbidities like diabetes, cardiovascular diseases, and tumors, and all of them are considered risk factors for COVID-19 severity and mortality [3].

The following databases, PubMed, ScienceDirect, Google Scholar, and medRxiv, were searched up to 23 May 2021 using COVID-19 and Bariatric surgery and their related MeSH terms. Studies were included if they were cohort or case control in design, included COVID-19 patients, compared between bariatric surgeries patients and control group in terms of COVID-19 severity and mortality, and adjusted for confounding variables. The exposure of interest was bariatric surgery regardless of the type of surgery and the outcome of interest was COVID-19 severity and mortality. COVID-19

mortality was defined as death and COVID-19 severity was defined as mechanical ventilation and intensive care unit (ICU) admission. The search results were screened using title and abstract then the remaining articles were tested against the inclusion criteria using its full-text form. The quality of the included studies was assessed using the Newcastle-Ottawa Scale for observational studies (NOS). The adjusted odds ratio (OR) and its related 95% confidence interval (95%CI) were pooled using the random effect model using Meta XL, version 5.3 (EpiGear International, Queensland, Australia). Cochran's Q heterogeneity test and I² statistic were performed to estimate the heterogeneity.

The search yielded 1599 articles; after deduplication and applying the inclusion criteria, 3 articles [4–6] were included in the analysis (Fig. 1). The total number of COVID-19 patients in the included articles was 9269. Of them, 13.3% (698/9269) underwent bariatric surgery and the rest were controls. The quality of all of the included studies was good (9/9). Furthermore, 8.5% (58/698) of bariatric surgery patients developed severe COVID-19 infection and 3.9% (27/698) of them died. In comparison, 16.1% of controls developed severe COVID-19 infection (1382/8571) and 13.7% (1174/8571) of them died. The characteristics of the included studies are described in Table 1. The analysis showed that bariatric surgery was significantly associated with reduced risk of COVID-19 severity (Fig. 2; OR = 0.46; 95%CI: 0.24–0.88) and the heterogeneity of this model was significant (I² = 67%; P-value = 0.05). Moreover, bariatric surgery was significantly associated with a reduced risk of COVID-19 mortality (Fig. 3; OR=0.50; 95%CI: 0.33–0.76) and the heterogeneity of this model was insignificant (I² = 0%; P-value = 1.00).

Our analysis revealed that patients with a history of bariatric surgeries had a significant reduction by 54% in the risk of ICU admission and mechanical ventilation due to COVID-19. This result was similar across the included studies as all of

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Table 1 The characteristics of the included studies

Study	Country	Study design	Number of participants	Age for the control group (median/mean ± STDV)	Age for the bariatric surgery group (median/mean ± STDV)	BMI for the control group	BMI for the bariatric surgery group	Number of patients who developed severe COVID-19 infection in the control group (%)	Number of patients who developed severe COVID-19 infection in the bariatric surgery group (%)	Number of patients who died due to COVID-19 infection in the control group (%)	Number of patients who died due to COVID-19 infection in the bariatric surgery group (%)	Adjusted confounding variables	Score
Amenian et al.	USA	Retrospective cohort	363	49.8 ± 14.3	46.1 ± 12.7	46.7 ± 6.4	37.2 ± 7.1	65/330 (19.7)	0/33 OR = 0.06 (0.00–1.00)	8/330 (2.4)	0/33 OR = 0.57 (0.03–10.03)	BMI, sex, age, race, ethnicity, smoking status, history of hypertension, diabetes, coronary artery disease, heart failure, asthma, COPD, cancer, and use of a steroid, angiotensin-converting enzyme inhibitor, or angiotensin receptor blocker	9
Jenkins et al.	USA	Retrospective cohort	620	52.1 ± 12.9	51.7 ± 12.6	41.4 ± 6.5	36.1 ± 8.3	159/496 (32.1)	20/124 (16.1) OR = 0.41; 95%CI: 0.24–0.68	68/496 (13.7)	8/124 (6.5) OR = 0.51; 95%CI: 0.22–1.17	Age, gender, BMI, race/ethnicity, diabetes, hypertension, hyperlipidemia, history of MI, and history of stroke	9
Iannelli et al.	France	Retrospective cohort	8286	59.8 (12.4)	49.8 (12.0)	-	-	1158/7745 (15)	38/541 (7) OR = 0.67; 95%CI: 0.48–0.95	1098/7745 (14.2)	19/541 (3.5) OR = 0.50; 95%CI: 0.31–0.80	Sex, hypertension, age range, diabetes and cardiac failure	9

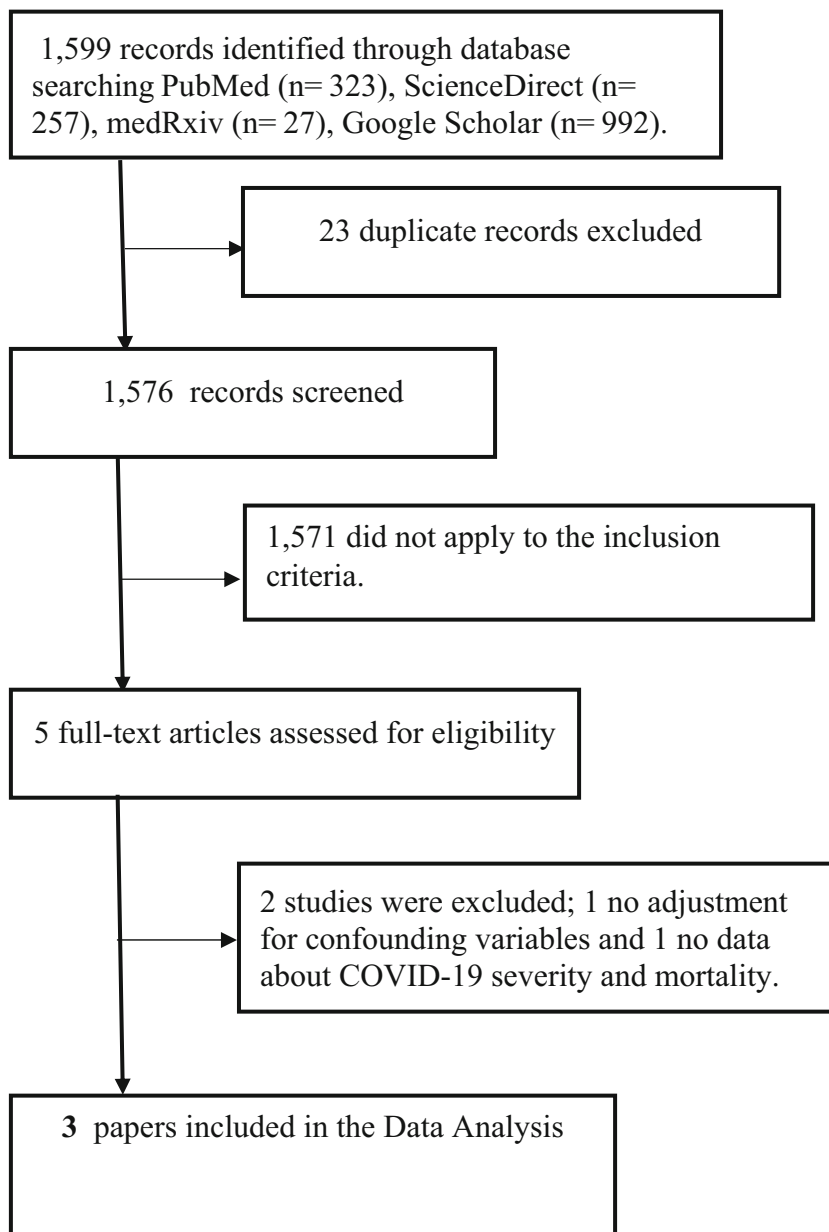
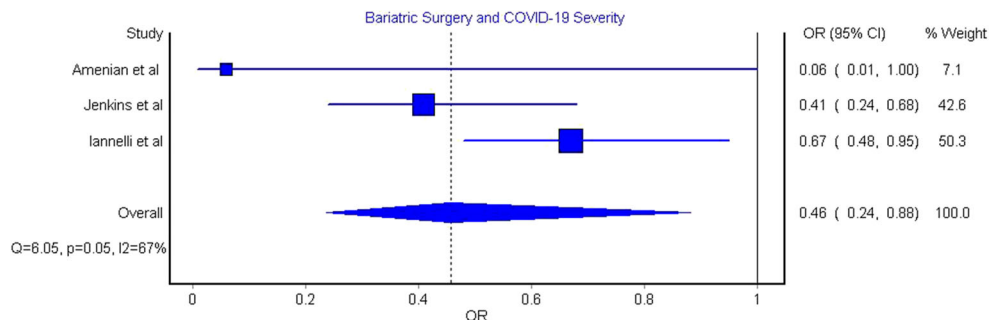


Fig. 1 PRISMA flow chart: 1,599 records identified through database searching PubMed (= 323), ScienceDirect (n= 257), medRxiv (n= 27), Google Scholar (n= 992)

them showed a significant reduction in the risk of ICU admission and mechanical ventilation among COVID-19 patients

with a history of bariatric surgeries. Furthermore, our results showed that COVID-19 patients with a history of bariatric

Fig. 2 Bariatric surgeries and COVID-19 severity



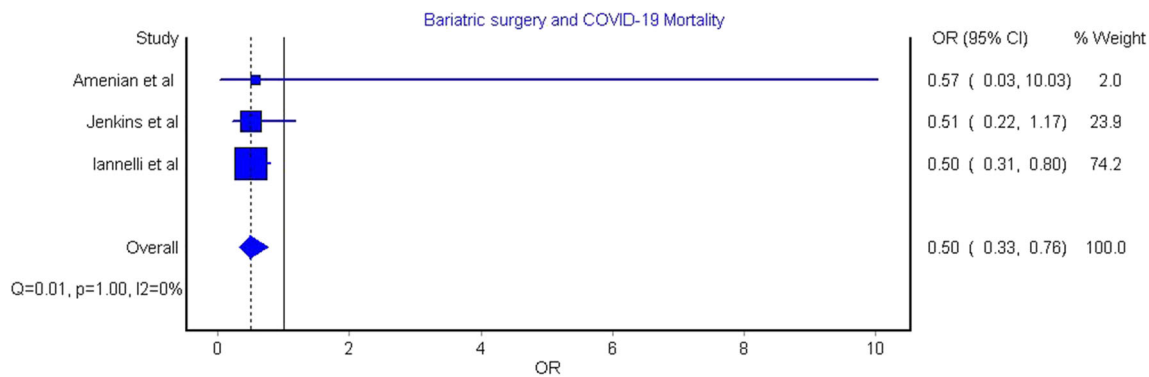


Fig. 3 Bariatric surgeries and COVID-19 mortality

surgeries had a significantly lower risk of COVID-19 mortality by 50%. This finding was consistent across all the studies but only one reached the significance level.

Previous studies showed that obesity is associated with poor COVID-19 outcomes [7] and it's well established that bariatric surgeries are very effective in weight reduction. Moreover, bariatric surgeries improve several comorbidities including but not limited to hypertension, cardiovascular diseases [8], and diabetes [9], and all of these factors had been correlated to COVID-19 adverse outcomes [3]. This suggests that the benefits of bariatric surgery on COVID-19 outcomes are due to the improvement in one of the aforementioned comorbidities or a combination of all of them.

Since our meta-analysis included a large number of COVID-19 patients, who underwent bariatric surgeries, from three studies and all of them were adjusted extensively for multiple potential confounding factors, the findings can be considered reliable. Our findings suggest a reduction in COVID-19 mortality and severity among patients with a history of bariatric surgeries. This supports the evidence that obesity is a very important risk factor among COVID-19 patients. Also, this substantiates the benefits of bariatric surgeries in improving the outcomes of several diseases. However, much is left to be determined about which type of surgery is more effective and how much time is needed to get the beneficial effects of bariatric surgeries. We await more data from well-designed prospective studies to support our results.

Declarations

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent Not applicable.

Conflict of Interest The author declares no competing interests.

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