



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

## Editorial comment

## Comment on: The impact of bariatric surgery on the risk of hospitalization due to influenza virus infection

I perused with interest the manuscript entitled "The Impact of Bariatric Surgery on the Risk of Hospitalization Due to Influenza Virus Infection" by Valera et al., where by using the National (Nationwide) Inpatient Sample (NIS) data collected from 2010–2015, a total of 2,300,845 subjects were reviewed, of which 2,004,804 were controls and 296,041 had bariatric surgery [1]. The numbers showed that the hospitalization rate in the bariatric surgery group was significantly lower (by nearly 3-fold) compared with the control group (.007% versus .019%,  $P < .0001$ ), which was corroborated after adjusting for covariables (control versus treatment: OR = 2.21,  $P = .0010$ ) [1]. This finding is in accordance with other viral epidemiologic studies showing a decrease in hospitalization, like for example, during the present COVID-19 pandemic. It is now well known that risk factors for early deaths after COVID-19 are diabetes (hazard ratio [HR] range 1.2–2.0), obesity (odds ratio [OR] range 1.5–1.75), heart failure (HR range 1.3–3.3), chronic obstructive pulmonary disease [COPD] (HR range 1.12–2.2), dementia (HR range 1.4–7.7), liver cirrhosis (OR range 3.2–5.9) and active cancer (OR range 1.6–4.7) [2]. Of note, obesity was worse than heart failure, and a combination of obesity and diabetes, a frequent occurrence magnifies the risk.

What is behind this? Obesity is associated with inflammation and decreased immune functions. Marzullo et al. [3] have examined patients with morbid obesity and age- and sex-matched controls. They found that compared with controls, all the leukocyte components were significantly augmented in obesity ( $P < .0001$ ), except for basophils and eosinophils. While IgA and IgG levels were similar between groups, IgM levels were lower ( $P < .001$ ) in individuals with obesity [3]. Furthermore; a significant association was evident between leptin and leukocytes ( $P < .001$ ), with interconnection to insulin resistance, adiposity, and lipid profile. This occurrence, and the significant correlation seen between leptin and IgA levels, may suggest a role of leptin in the immune modifications consequential to obesity [3]. Mancuso has made a link between leptin and respiratory infections [4]. Obese leptin-deficient humans and leptin and leptin-receptor-deficient mice display superior susceptibility to respiratory infections, insinuating a prerequisite for leptin in the lungs and immunogenic reaction to infectious

processes. They have detected that obese leptin receptor signaling mutant mice are resistant to pneumococcal pneumonia. Additional clinical and animal studies are needed to clarify the relationship between increased adiposity and susceptibility to acquire and nosocomial pneumonia [4].

It was also found by Divoux et al/ [5] that mast cells are activated in human adipose tissue and localized preferentially in fibrosis depots, a local circumstance that arouses their inflammatory state. More specifically, mast cells with tryptase (+) chymase (+) staining leaned to be higher in obese omental adipose tissue. They found positive links between mast cell number and several characteristics of obese tissue including fibrosis, macrophage accumulation, and endothelial cell inflammation. Mast cell numbers and their inflammatory phenotype are linked with diabetes factors [5].

But mostly these changes were reversed after bariatric surgery; indeed, Miller et al. [6] demonstrated that fasting levels of plasma inflammatory adipokines, including leptin, adiponectin, C-reactive protein (CRP), interleukin-6, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), and soluble receptor 1 for TNF- $\alpha$  were altered after bariatric surgery (Roux-en-Y gastric bypass). Indeed leptin, CRP, and soluble receptor 1 for TNF- $\alpha$  declined, and adiponectin levels strengthened from the baseline. These reduced pro-inflammatory biomarkers and amplified anti-inflammatory mediators of obesity, surprisingly, were modified independently of dramatic weight loss changes [6].

Therefore, the present study supports previous research on the subject, and it is likely that other viral diseases clinical courses are affected by bariatric surgery; not only does it affect metabolic syndromes and early deaths from coronary, circulatory diseases, and diabetes, but it also affects the outcomes of viral infections. As suggested by Mancuso [4], assuming the redoubled prevalence of obesity, and meager responsiveness of individuals with obesity to vaccination against influenza, the elaboration of innovative immunization stratagems for this population is merited.

Michel Gagner, M.D.  
Hôpital du Sacre Coeur  
Montreal, Canada  
Westmount Square Surgical Center  
Westmount, Canada

## References

- [1] Valera R, Botero-Fonnegra C, Cogollo V, et al. Impact of bariatric surgery on the risk of hospitalization due to influenza virus infection. *Surg Obes Relat Dis* 2021;17(12):1977–83.
- [2] Treskova-Schwarzbach M, Haas L, Reda S, et al. Pre-existing health conditions and severe COVID-19 outcomes: an umbrella review approach and meta-analysis of global evidence. *BMC Med* 2021;19(1):212.
- [3] Marzullo P, Minocci A, Giarda P, et al. Lymphocytes and immunoglobulin patterns across the threshold of severe obesity. *Endocrine* 2014;45(3):392–400.
- [4] Mancuso P. Obesity and respiratory infections: does excess adiposity weigh down host defence? *Pulm Pharmacol Ther* 2013;26(4):412–9.
- [5] Divoux A, Moutel S, Poitou C, et al. Mast cells in human adipose tissue: link with morbid obesity, inflammatory status, and diabetes. *J Clin Endocrinol Metab* 2012;97(9):E1677–85.
- [6] Miller GD, Nicklas BJ, Fernandez A. Serial changes in inflammatory biomarkers after Roux-en-Y gastric bypass surgery. *Surg Obes Relat Dis* 2011;7(5):618–24.

<https://doi.org/10.1016/j.soard.2021.09.014>