

## Paradoxical Obesity and Intracranial Aneurysms: A Mini Review

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### Abstract

Body mass index above 30 is an independent risk factor for cardiovascular disease and linked to poor prognosis, especially in patients admitted to intensive therapy departments. However, recent reports have indicated that individuals with mild to moderate obesity have favorable outcomes in the survival in coronary heart disease and either in hemorrhagic or ischaemic stroke. The same association has been also encountered in patients who had ruptured intracranial aneurysms. These patients are although obese, they stay metabolically healthy with apparent protection from the disease. More studies are needed to determine its consistent correlation. Obesity, the body mass *index* or Quetelet *index* and its correlation intracranial aneurysms were briefly examined in this article.

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### Introduction

More than 2500 years, Hippocrates described the association between cerebrovascular or cardiovascular diseases in individuals with obesity and overweight causing sudden death [1,2]. Both obesity and overweight are rapidly advancing in worldwide and has become a socio-political problem due to the fact to be an independent risk factor for cardiovascular disease particularly in developing countries [3-5].

World obese populations have doubled since 1980.3,4According to National US studies, it has been estimated that more than one-third (about 35% or more than 78 million individuals) are obese and more than 70% of American adults are affected by obesity and/or overweight [6,7]. Further studies carried out by World Health Organization (WHO) have found that both obesity and overweight also affects over 50% of the South American populations [4].

For immediate primary care of the population estimates by the WHO already showed increased mortality from nutritional chronic diseases in Brazil of up to 22% by 2015 [4,5]. Although not yet have accurate data in the northeast of Brazil, is known the number of cases of type 2 diabetes is increasing every day as well as childhood obesity, among other associated factors such as physical inactivity and poor diet, excessive consumption of the simple carbohydrates and excess saturated and trans fats. The association of obesity with abdominal aortic aneurysm is also a great indicator and risk factor to worsen the picture of morbidity, because reducing body weight, reduces associated risk as anthropometry measures and other diagnostics [7].

### Obesity, Overweight and Quetelet index

According to National Institutes of Health in Bethesda, overweight is defined as having excess body weight for a particular height from fat, muscle, bone, water, or a combination of these factors [8]. And the obesity is defined as having excess body fat [8]. The term body mass index (BMI) was based in Quetelet's theory of human trait measurement based in normal curve [9]. This term is universally adopted as screening population measurement [10,11]. Adults with the BMI greater than or equal to 25 are considered overweight and those with BMI greater or equal to 30 are considered obese [8-10].

### Related Risk and Protective Factors

Obesity and overweight are independent risk factors for cardiovascular diseases, cancer, diabetes, hypertension, musculoskeletal disease and stroke. However, since 1999 when the first description about obesity-survival was performed based on survival advantage for overweight and obese patients undergoing hemodialysis, a large studies supporting the paradoxical obesity in several conditions has published.

Several epidemiological studies have showed that obese individuals with coronary heart disease demonstrated a clear survival advantage compared with their nonobese cohorts [12,13]. Recent studies described the same outcome in patients with mild and moderate obesity who had chronic obstructive pulmonary disease, ischemic and haemorrhagic stroke and subarachnoid haemorrhage (SAH) [13-16].

Cigarette smoking, hypertension, alcohol consumption, estrogen deficiency, collagen diseases, atherosclerosis, ageing and female sex also appear to be involved in the formation, growth and rupture of intracranial aneurysms [15,17-18]. Obesity and other modifiable risk factors, such as hypercholesterolemia, ischemic heart disease, diabetes mellitus are limited and conflicting and controversial. Hypercholesterolemia and regular physical exercise appear to decrease the risk of aneurysm formation; there is some speculation that the former effect is mediated through statin therapy.

We recently reviewed main sources of researches as Embase, Pubmed and Cochrane (CENTRAL), Allied, Amed, BNI, CINAHL, Health Business Elite using key-terms correlated changes in weight, obesity paradox with intracranial aneurysms, hemorrhagic stroke and SAH over the last 30 years [19]. A total of 690 studies were found, 45 were duplicates, 147 showed stroke and "paradox obesity" association.

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After reading all relevant articles, only one study from Vlak et al. [17], studying 206 patients with unruptured intracranial who never had a SAH and 574 controls who were randomly retrieved from general practices of area of catchment of Utrecht. Unruptured aneurysms and obesity were consistently correlated unruptured, however no significant statistical correlation was founded [17].

Two main studies correlated obesity and ruptured aneurysms [17,20]. Both studies indicated that obesity reduces mortality to short and long term, although remain controversial with regard to functional recovery. First one was performed by Platz et al. 14 analyzing 741 patients with the history of SAH secondary to intracranial aneurysms: 36.2% or 267 patients were overweight and 15.2% or 113 patients were obese. Although many physicians anticipated a worse outcome for the obese patient the BMI was not an independent predictor of outcome [15].

In the Platz' study the multivariate analysis, only age (OR:1.051, 95% CI: 1.04-1.07,  $p < .001$ ), WFNS grade (OR:2.095, 95%, CI:1.87-2.35,  $P < .001$ ), occurrence of vasospasm (OR:2.90, 95% CI:1.94-4.34,  $P < .001$ ) and aneurysm size larger than 12 mm (OR: 2.215,95% CI:1.20-4.10,  $P=0.11$ ) were independent predictors of outcome after 6 months. Of the 321 poor grade patients (WFNS score  $>3$ ), 171 (53,3%) were overweight. Of these, 21.6% attained a favorable outcome compared with 35.3% of normal-weight patients ( $P=.006$ ). Based on the BMI, obesity seems to be negligible for outcome after SAH compared with the impact of SAH, the patient's age, the occurrence of vasospasm, or aneurysm size [15].

Another recent study of Tawk et al. [20] investigated 274 consecutive patients admitted with SAH between 2008 and 2012. After performing a multivariate analysis adjusting for an age, the older age was associated with worsened severity and that BMI was not noticeably associated with severity bleeding or functional outcome in patients with SAH.

Although the obesity paradox correlation has limited evidence patients with intracranial aneurysms appear to overlap other vascular conditions as heart ischemic disease and stroke. The reason for the paradox has yet to be defined and the related mechanisms are still unknown. It appears to be the same underlying mechanism observed in hypercholesterolemia and regular physical exercise and weight of loss [21].

A better nutrition and increased metabolic reserve appear to confers a kind of protection against endotoxin inflammatory cytokines and survival advantages. The exercise associated with good nutrition not only preserves muscle strength and its vascular dynamics, reducing circulating glucose, thereby increasing the effectiveness of insulin released as improving appetite and mood. Futures and more consistent studies are needed.

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