REVIEW ARTICLE

OBESITY AND ATRIAL FIBRILLATION – BARIATRIC SURGERY AS A METHOD OF AF RISK DECREASE

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ABSTRACT

The prevalence of obesity is growing at alarming rate worldwide. Obesity has reached the proportion of a global epidemic in both developed and developing countries. Growing number of obese patients with atrial fibrillation requires a closer look at how excessive body fat leads to AF. Excessive adipose tissue is the source of many cardiovascular diseases, like hypertension, ischemic heart disease, and arrhythmias such as atrial fibrillation. The prevalence of atrial fibrillation in the general population is estimated at 1-2%. Obesity and overweight occur in 25% of patients with AF. Pathophysiology of obesity and the relationship between atrial fibrillation, diabetes, obstructive sleep apnea and metabolic syndrome are presented in this article as well as the benefit of bariatric surgery in qualifying patients. Paroxysmal AF and its risk factors should be carefully assessed in all patients referred for bariatric surgery. Proper diagnosis allows physicians to introduce appropriate anticoagulant prophylaxis, and significantly lower complication rate. Antiarrhythmic, respiratory, and metabolic therapy should also be considered in preoperative and postoperative care.

KEY WORDS: atrial fibrillation, obesity, bariatric surgery, diabetes, obstructive sleep apnea, metabolic syndrome

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INTRODUCTION

Atrial fibrillation (AF) is the most common arrhythmia. The main clinical risk factors are age, diabetes, hypertension, heart failure and chronic heart disease. Recent studies have revealed a significant impact of obesity for atrial fibrillation occurrence. Currently estimated prevalence of AF in adults is between 2% and 4%, and a 2.3-fold rise is expected, related to longevity in the general population and intensified search for undiagnosed AF. New Guidelines for diagnosis and management of atrial fibrillation [1] emphasizes increased prevalence of other risk factors for AF in population. Those include hypertension, diabetes mellitus, heart failure (HF), coronary artery disease (CAD), chronic kidney disease (CKD), obesity, and obstructive sleep apnea (OSA). Obesity is one of the most common life-style-related health problem, and some studies have shown it can be an independent risk factor for atrial fibrillation (AF) [2, 3]

Obesity is defined as a body mass index (BMI) ≥30 kg/m^2 (weight in kilograms/height^2 in meters). There are 3 classes of obesity: I degree (BMI: 30-34,5 kg/m^2), II degree (BMI: 35-39,9 kg/m^2) and III degree, also called morbid obesity (BMI ≥40 kg/m^2). In 2016, over 650 million adults were obese, and more than 1.9 billion adults were overweight (39% of men and 40% of women) [4]. Current evidence suggests that surgical therapies offer morbidly obese patients the best chance for substantial and sustainable weight loss, resulting in reduction in morbidity and mortality [5].

THE AIM

This work aims to summarize the data available in literature about relationship between occurrence of atrial fibrillation and risk factors, including excessive adipose tissue. The pathophysiological pathways leading to obesity have been described. Individual phenomena coexisting with obesity, such as diabetes, obstructive sleep apnea and metabolic syndrome, have been distinguished. Finally, the data after bariatric surgery in obese patients and the benefits of such surgery are presented.

MATERIALS AND METHODS

This article is analysis of literature about relationship between occurrence of atrial fibrillation and risk factors, including excessive adipose tissue.

REVIEW AND DISCUSSION

PREDICTORS AND RISK FACTORS

Obesity, hypertension, heart failure and ischemic heart disease are recognized factors for the AF. Many of these risk factors can coexist in one individual. Several studies have found a correlation between weight, height, body mass index (BMI), body structure area (BSA) and AF.

Large body size at a young age anticipated development of AF in further life. Higher BMI and BSA in adolescence are strongly related with AF in future [6]. Obesity is also associated with an increased risk of transition from paroxysmal AF to persistent AF. The link between obesity and AF was observed in patients in cardiovascular operation analysis. Furthermore, this association remained unchanged even after adjusting for myocardial infarction, hypertension and diabetes [7]

Overweight and obese individuals often develop left ventricular (LV) dilation, which is also an AF predictor. The multicenter CARDIOBESE study conducted on 100 obese patients undergoing bariatric surgery showed evidence of impaired left ventricular ejection fraction, global longitudinal strain (GLS) and diastolic dysfunction in significant number of patients. The incidence of subclinical heart dysfunction measured in GLS in obese patients is 56%, which appears to be associated with abdominal obesity [7, 8]. Left ventricular enlargement and AF relationship is not completely understood. It is likely to be multifactorial process, involving hemodynamic disturbances, autonomic dysfunction, and induction of the renin-aldosterone-angiotensin-system (RAAS), resulting in mechanical and electrical remodeling of the left atrium.

In the CARDIOBESE study, obese patients had higher levels of C-reactive protein (CRP). Previous studies have shown that CRP levels are elevated in patients with persistent AF compared to control group and patients with paroxysmal AF. Pericardial fat thickness strongly correlates with visceral fat, which has been documented with magnetic resonance imaging (MRI). Adipocytes, the main adipose tissue component, release cytokines (adipocytokines) with pro-inflammatory and vasoactive properties. These properties are associated with the pathogenesis of many cardiovascular diseases, including arrhythmias [9]. Recent study on rats have shown that diet-induced weight loss reverses obesity-induced PVAT damage through a mechanism involving reduced inflammation and increased nitric oxide synthase activity within PVAT. These data reveal inflammation and nitric oxide synthase, particularly endothelial nitric oxide synthase, as potential targets for the treatment of PVAT dysfunction associated with obesity and metabolic syndrome. [10].

Studies report that atrial fibrillation is twice more common in patients with diabetes. In a study on a large group of patients with newly diagnosed type 2 diabetes, at baseline overweight or obesity, a significantly higher risk of AF was documented. Patients with type 2 diabetes can benefit from weight-loss by reducing the risk of AF [11]. Vascular and nerve neuropathy, which are caused by diabetes, are indirectly associated with AF through changes in the mechanical and electrical remodeling of the atrium.

Metabolic syndrome (MS), which is often associated with obesity, is a set of related factors, consists of a larger waist circumference (men ≥94 cm, women ≥80 cm), hypertriglyceridemia, decreased HDL, increased blood pressure, and abnormal glycemia. Recent study shown that biomarkers associated with pathogenesis of AF in the context of MS have the ability to refine future risk prediction. Cardiac myocyte injury androponin, natriuretic peptides, markers of renal function (glomerular filtration rate, cystatin-C), and inflammation markers/mediators (interleukin-6, CRP) are possible biomarker of AF risk in obese patients [12].

Obstructive sleep apnea (OSA) is highly prevalent in obese people. In the study on the group of patients undergoing bariatric surgery, almost 3/4 of this group had OSA [13]. OSA is also associated with increased risk of AF after cardiac surgery. The pathomechanism of AF formation in people with OSA may be associated with repeated and prolonged hypoxemia, intrathoracic pressure oscillation with increased preload of the heart, systemic inflammation and diastolic dysfunction, as well as autonomic disorders [14].

BARIATRIC SURGERY

Current therapies for AF are not very effective in obese patients. Bariatric surgery may become a new therapeutic option but requires further research. This method has been proven to effectively reduce body mass. Additionally, bariatric surgery and associated weight loss has been found to reverse the structural cardiac changes associated with AF such as LA dilation, as well as cure type II diabetes and obstructive sleep apnea [15]. Criteria for bariatric surgery in the adult patient group (age 18-60) are a BMI ≥40 kg/m^2 or a BMI ≥35 kg/m^2 with the presence of high-risk comorbid conditions. That includes diabetes type 2, respiratory disease (obstructive sleep apnea, asthma), cardiovascular diseases (cardiomyopathy), musculoskeletal (back strain, disc disease, weight- bearing osteoarthritis of the hips), and body mass that interfere with social and family life. Surgical treatment of obesity may also be considered in patients with BMI 30.0-34.9 kg/m^2 and type 2 diabetes, in the case of persistent hyperglycemia despite the use of oral medications and insulin. According to the American Society for Bariatric Surgery that method is the most effective therapy available for morbid obesity and can result in improvement or complete resolution of obesity comorbidities. Several operative procedures are currently in general use worldwide: sleeve gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), mini gastric bypass / omega loop gastric bypass (MGB/OLGB), adjustable gastric banding (AGB), biliopancreatic diversion (BPD), biliopancreatic diversion/duodenal switch (BPD-DS). Newer methods include gastric plication, single anastomosis duodeno-ileal bypass – SADI and ileal interposition. Endoscopic methods of obesity treatments are gastric balloon (due to the lack of maintenance of safety devices and the repair of end devices of this method, which ensure the performance of operations that are performed, or that are of high-quality BMI, as well as recorded operational inspections) [15-18]

Bariatric surgery reduces obesity-related disorders that indirectly affect the development of AF. In patients undergoing bariatric surgery, the risk of either HF or AF was reduced by ~29%. Those findings support hypothesis that weight loss reduces a long-term risk of HF or incident AF hospitalization [19, 20].

The substantial amount of weight loss (after RYGB sur-

gery) was associated with significant reduction of comorbidities, especially in diabetics and in people leading a sedentary lifestyle [20]. Bariatric surgery has a significant impact in the increase of hypertension, hyperlipidemia and obstructive sleep disease. Surgical procedures of weight reduction are associated with lower cardiovascular mortality, lower cardiovascular incidents in operated versus medical therapy. There was a significant reduction in the number of heart attacks, deaths caused by heart attacks, strokes and deaths caused by strokes. [21]. In a prospective study on a group of patients undergoing weight reduction surgery, the following scales were used: Finnish Diabetes Risk Score, Reynolds Risk Score, Italian "Progetto Cuore" score, SCORE, most patients had reduced cardiovascular risk after surgery [22].

Surgically induced weight loss significantly reduces the occurrence of obesity-related sleep apnea incidents, and also improves sleep quality parameters. Recent study has shown significant improvement in Epworth Sleepiness Scale (ESS) scores, apnea-hypopnea index, oxygen desaturation index and sleep architecture parameters. Bariatric surgery is associated with a significant decrease in the number of sleep-related respiratory disturbances, as well as improvement of sleep efficiency [23].

Thromboembolism is a topic of discussion in the context of bariatric surgery as a reduction in the risk of AF. Obesity itself is a risk factor for thromboembolism. Minimizing AF also reduces risk of stroke and thromboembolism [24].

There are several methods of AF treatment dependent on paroxysmal or persistent character of arrhythmia. It is necessary to eliminate arrhythmia-promoting factors and obesity is one of them. The next stage is the implementation of antiarrhythmic treatment or restoration of sinus rhythm by DC electrical or pharmacological cardioversion in persistent fibrillation. Percutaneous ablation has an increasingly important role in the treatment of AF. According to the European Society of Cardiology guidelines on AF, percutaneous AF ablation is indicated in the case of ineffectiveness or intolerance of antiarrhythmic pharmacotherapy in patients with symptomatic, paroxysmal and persistent AF to reduce arrhythmia symptoms. Performing ablation in an obese person creates a huge difficulty for the surgeon. The introduction of catheters through the femoral vein is often impossible in patients with high BMI and the radiation dose needed to perform the procedure is definitely higher than in patients with normal body weight. There is a higher incidence of postoperative complications. In addition, obesity may increase the incidence of AF relapses after percutaneous ablation [25].

CONCLUSIONS

These days obesity is an epidemic. It is important to have knowledge about their pathomechanism to be able to implement appropriate therapy in the future. Although research shows that obesity directly affects the development of AF, this arrhythmia consists of various pathophysiological pathways that overlap.

The AF appears more frequently in patients with diabetes, metabolic syndrome and obstructive sleep apnea. All these glides often coexist, negatively affect the cardiovascular system and usually occur in people with obesity. It seems that bariatric surgery can have positive effects in the treatment of not only obesity, but also complications that obesity carries, including atrial fibrillation – dangerous arrhythmia and carrying a high risk of thromboembolism.

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