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The effects of abdominal lipectomy in metabolic syndrome components and insulin sensitivity in females: A systematic review and meta-analysis

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ABSTRACT

Background. Adipose tissue is an endocrine organ, which is implicated in the pathogenesis of obesity, metabolic syndrome and diabetes. Lipectomy offers a unique opportunity to permanently reduce the absolute number of fat cells, though its functional role remains unclear. This systematic and meta-analysis review aims to assess the effect of abdominal lipectomy on metabolic syndrome components and insulin sensitivity in women.

Methods. A predetermined protocol, established according to the Cochrane Handbook's recommendations, was used. An electronic search in MEDLINE, Scopus, the Cochrane Library and CENTRAL electronic databases was conducted from inception to May 14, 2015. This search was supplemented by a review of reference lists of potentially eligible studies and a manual search of key journals in the field of plastic surgery. Eligible studies were prospective studies with ≥1 month of follow-up that included females only who underwent abdominal lipectomy and reported on parameters of metabolic syndrome and insulin sensitivity.

Results. The systematic review included 11 studies with a total of 271 individuals. Conflicting results were revealed, though most studies showed no significant metabolic effects after lipectomy. The meta-analysis included 4 studies with 140 subjects. No significant changes were revealed between lipectomy and control groups.

Conclusions. This meta-analysis provides evidence that abdominal lipectomy in females does not affect significantly the components of metabolic syndrome and insulin sensitivity. Further high quality studies are needed to elucidate the potential metabolic effects of abdominal lipectomy.

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1. Introduction

Obesity is an escalating global epidemic of the modern era, which affects virtually all age and socioeconomic groups with 1.7 billion people classified as obese [1]. It poses a major risk for cardiovascular disease (CVD), type 2 diabetes (T2DM), hypertension, stroke, certain types of cancer and mortality [2,3]. Abdominal obesity, along with elevated serum triglycerides, low HDL-cholesterol, elevated blood pressure and insulin resistance, is considered a component of the metabolic

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syndrome (MetS) [4]. Currently, approximately one third of the adult population suffers from MetS, having increased risk for the development of T2DM and CVD [5,6]. Treatment options for obesity include non-surgical treatment, usually a comprehensive lifestyle intervention program comprising diet, physical activity, behavioral therapy and/or pharmacotherapy, and bariatric surgery [7]. These therapeutic modalities can improve body weight and reduce the risks associated with MetS [8–10].

Adipose tissue is no longer considered as just a lipid storage depot, but an endocrine organ, which secretes a plethora of proteins (adipokines) and bioactive mediators and has a central role in energy and glucose homeostasis [11]. It is well-established that adipose tissue has an impact on metabolic health, contributing to the pathogenesis of obesity, MetS and T2DM. Interestingly, body fat distribution to upper- and lower-body fat depots exhibits unique characteristics and functional properties, which are associated with the metabolic risks [12]. Upper or abdominal adipose tissue correlates with an increased susceptibility for obesity-related metabolic complications, while lower or gluteofemoral adipose tissue is associated with reduced metabolic risks [13,14]. In addition, adipose tissue presents gender-specific differences in terms of adipogenesis, expression of developmental genes, storage and release of fatty acids and secretory function [15,16].

The recognition of the role of the adipose tissue in the pathogenesis of MetS, along with the positive effects of bariatric surgery, led to the hypothesis that removing excess subcutaneous adipose tissue would ameliorate the detrimental effects of obesity. Lipectomy offers a unique opportunity to permanently reduce the absolute number of fat cells, though its functional role remains unclear [17].

The present systematic review and meta-analysis aim to comprehensively summarize the effects of lipectomy of the abdomen (abdominoplasty or liposuction) compared with surgical and non-surgical treatment on the components of MetS and insulin resistance in females.

2. Methods

A systematic review and meta-analysis were conducted using a predetermined protocol established according to the Cochrane Handbook's recommendations [18]. Results were reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (eTable 1) [19].

2.1. *Search Strategy*

An electronic literature search in MEDLINE (PubMed), Scopus, the Cochrane Library and CENTRAL electronic databases was conducted from inception to May 14, 2015. The string search ["*lipectomy*" or "*liposuction*" or "*abdominoplasty*"] and ["*obesity*" or "*overweight*" or "*metabolic*" or "*cardiovascular*" or "*inflammatory*" or "*triglycerides*" or "*cholesterol*" or "*blood pressure*" or "*insulin*" or "*insulin resistance*" or "*diabetes*" or "*glucose*"] was applied, and limited to "*human*". No time and language restriction was applied. This search was supplemented by a review of reference lists of potentially eligible studies and a manual search of key journals in the field of plastic surgery.

2.2. *Study Selection*

The intervention of interest was lipectomy of the abdominal region, either abdominoplasty or liposuction. Studies met the following inclusion criteria: (1) prospective design; (2) evaluation of adult female patients only; (3) reported data on the parameters of MetS and insulin resistance before and after the operation; (4) a minimum follow up of 1 month to eliminate the confounding effects of postsurgical inflammation on the study end-points; (5) publication in a peer-reviewed journal. In studies with more than one end-point, the longest follow-up was used. Studies of liposuction in areas other than the abdomen, studies with patients on concomitant weight management strategies (diet, exercise or medication) or with endocrine conditions (T2DM, thyroid dysfunction etc), duplicate reports, case reports and case series, editorials and correspondences were excluded (Fig. 1). Two reviewers (K.S. and D.G.) independently screened retrieved database files and the full text of potentially eligible studies for relevance. Disagreement was resolved by consensus.

2.3. *Data Collection and Risk of Bias Assessment*

Data extraction was conducted independently by two reviewers (K.S. and D.G.) using a standardized form. Discrepancies were resolved by consensus. In case of missing data, two e-mail attempts, sent 15 days apart, were made to contact the authors of the original studies. Extracted data included general study characteristics, population characteristics and outcomes of interest: metabolic profile [total, HDL- and LDL-cholesterol, triglycerides, fasting glucose, systolic (SBP) and diastolic (DBP) blood pressure, waist circumference/Waist-to-hip ratio-WHR] and insulin sensitivity. All reported measurements of insulin sensitivity were extracted, such as euglycemic hyperinsulinemic clamp, insulin tolerance test and homeostasis model (HOMA) index.

The quality of studies was assessed using the Cochrane risk of bias tool [18].

2.4. *Data Synthesis and Analysis*

A narrative summary of the included studies was provided in the following order: surgical vs. non-surgical intervention comparisons; comparisons between surgical procedures; and observational studies of lipectomy with no comparison group. Studies were further categorized, based on follow-up time, to those presenting early (1–2 months), intermediate (3–12 months) and long-term outcomes (>12 months).

Meta-analysis of the outcomes of interest was performed when results were available from at least two studies. For continuous variables, the weighted mean difference (WMD) with 95% confidence interval (CI) was calculated [18]. The standardized mean difference (SMD) was used to estimate insulin sensitivity, standardizing the results of the studies to a uniform scale before they can be combined. Outcome measures were quantitatively summarized, using a random effects model. Significance level was set at $p \leq 0.05$.

Missing standard deviations were derived from other statistics, such as p values, standard errors or CIs. We imputed standard deviation for one study, using the mean standard deviation of the respective groups of the other