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Effect of Surgical versus Non-Surgical Treatment of Obesity on Blood Pressure among Non-compliant Patients

Mesfer Hussain S Alyami (1) *, Tariq Nasser Bin Yahya Haqawi (2), Layla Hussein Mohammed Awaji (3), Basmaa Yahya Mohammed Alghabri (4), Mohammed Jaber Al Faifi (5), Samira Jaber Al Faifi (3), Mona Ibrahim Hussain Algahtani (6), Ahssan Yahia Abdullah Al sawwan (3)

(1) Health Administration and Community Health, King Khaled Hospital -Najran, Saudi Arabia.
(2) Therapy and Rehabilitation, King Khaled Hospital -Najran, Saudi Arabia.
(3) Nursing, King Khaled Hospital -Najran, Saudi Arabia.
(4) Medical Secretary, King Khaled Hospital -Najran, Saudi Arabia.
(5) Pharmacy, King Khaled Hospital -Najran, Saudi Arabia.
(6) Nurse, Public Health Department, Najran, Saudi Arabia.

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*Corresponding author

Abstract

Introduction: Evaluating the comparative effectiveness of surgical versus non-surgical interventions on blood pressure outcomes is crucial for guiding clinical decisions. Existing literature suggests that bariatric surgeries not only result in significant weight loss but also lead to a notable reduction in blood pressure. This review aims to quantify the effects of each intervention and to identify potential mechanisms underlying these observed effects.

Methods: A thorough literature search encompassing multiple electronic databases, including PubMed/MEDLINE, Embase, Cochrane Library, and Scopus, was executed from inception to September 2023. The study selection process involved a two-step approach, initially screening titles and abstracts independently, with subsequent retrieval and assessment of full-text articles against predetermined eligibility criteria. Criteria included adult participants diagnosed with obesity, exclusive consideration of randomized controlled trials (RCTs) and controlled clinical trials (CCTs), and exclusion of pediatric studies, observational designs, reviews, and non-English language publications. Rigorous data extraction procedures, independently conducted by two reviewers, aimed at ensuring the reliability of this systematic review.

Results: Eight clinical trials, with a combined sample size ranging from 322 to 2,564 participants, were included in the systematic review, reflecting the diverse nature of obesity and its associated comorbidities. Notable findings from individual trials include a significant reduction in systolic blood pressure by an average of 12 mmHg and diastolic blood pressure by 8 mmHg in the gastric bypass group compared to lifestyle intervention over 12 months. Similarly, sleeve gastrectomy demonstrated a substantial decrease in systolic blood pressure by 15 mmHg and diastolic blood pressure by 10 mmHg compared to pharmacotherapy over 24 months. Collectively, the trials consistently indicate a more significant reduction in blood pressure with surgical interventions, emphasizing their potential cardiovascular benefits in obesity management and highlighting the importance of further research on long-term outcomes.

Conclusions: The systematic review of eight clinical trials presents compelling evidence supporting the superior impact of surgical interventions on blood pressure outcomes in individuals with obesity compared to non-surgical approaches. The consistently significant reductions in both systolic and diastolic blood pressure across diverse patient populations underscore the clinical relevance of bariatric surgery in addressing obesity-related hypertension, emphasizing the statistical advantage and potential long-term benefits of surgical interventions in the comprehensive management of obesity-related cardiovascular risks.

Keywords: ***Obesity, Bariatric Surgery, Blood Pressure, Cardiovascular Health, Clinical Trials***.

Introduction

Obesity has surged to epidemic proportions, affecting over 650 million adults globally, with a prevalence of approximately 13% of the world's population [1]. This alarming trend has significantly contributed to the burden of chronic diseases, including cardiovascular disorders, which account for 31% of global deaths [2]. Hypertension, a prevalent and modifiable risk factor, often accompanies obesity, with studies reporting that approximately 40-50% of hypertensive cases can be attributed to excess body weight [3]. The multifaceted approaches are available for managing obesity, surgical and non-surgical interventions have garnered considerable attention. Bariatric surgeries, such as gastric bypass and sleeve gastrectomy, have demonstrated substantial weight loss, with meta-analyses reporting an average excess weight loss of 60-70% at two years post-surgery [4].

Conversely, non-surgical strategies encompass lifestyle modifications, pharmacotherapy, and behavioral interventions. While these approaches may yield modest weight reductions, they remain integral components of obesity management, with studies indicating an average weight loss of 5-10% of initial body weight [5]. The impact of obesity treatment on blood pressure regulation is paramount, given that hypertension affects nearly 1.13 billion people globally. Evaluating the comparative effectiveness of surgical versus non-surgical interventions on blood pressure outcomes is crucial for guiding clinical decisions [6]. Existing literature suggests that bariatric surgeries not only result in significant weight loss but also lead to a notable reduction in blood pressure, with studies reporting a mean decrease of 10-15 mmHg systolic blood pressure and 6-10 mmHg in diastolic blood pressure [7]. Conversely, surgical interventions exhibit more nuanced effects on the blood pressure in lifestyle modifications and pharmacotherapy demonstrating variable success. Lifestyle interventions, such as diet and exercise, have been associated with modest reductions in blood pressure, typically ranging from 2-10 mmHg. Pharmacotherapy, including anti-obesity medications, may contribute to additional blood pressure improvements, albeit with varying efficacy and potential side effects [8, 9].

As this systematic review aims to amalgamate data from diverse studies, it will provide a comprehensive overview of the comparative effectiveness of surgical and non-surgical obesity treatments on blood pressure outcomes. By synthesizing available evidence, this review aims to quantify the effects of each intervention and to identify potential mechanisms underlying these observed effects. Ultimately, the synthesis of this evidence will be instrumental for healthcare practitioners and policymakers, offering valuable insights into the most effective strategies for managing obesity-related complications and hypertension.

Methods

To conduct this systematic review, a comprehensive literature search was performed across multiple electronic databases from inception to the latest available date at the end of September 2023, including PubMed/MEDLINE, Embase, Cochrane Library, and Scopus. The search strategy was developed using a combination of Medical Subject Headings (MeSH) terms and keywords related to obesity treatment, blood pressure outcomes, and clinical trials. The search terms included variations of "obesity," "bariatric surgery," "non-surgical interventions," "blood pressure," and "clinical trial." Boolean operators (AND, OR) were employed to refine the search and

ensure inclusivity. Study selection involved a two-step process. Initially, titles and abstracts were screened for relevance independently by two reviewers, with disagreements resolved through discussion or consultation with a third reviewer. Subsequently, full-text articles of potentially relevant studies were retrieved and assessed against predetermined eligibility criteria. Eligible studies included clinical trials that compared surgical interventions (e.g., gastric bypass, sleeve gastrectomy) with non-surgical interventions (e.g., lifestyle modifications, pharmacotherapy) for obesity, with a primary or secondary outcome related to blood pressure.

The predefined eligibility criteria encompassed studies involving adult participants (18 years or older) diagnosed with obesity, with no restrictions on sex, race, or comorbidities. Only randomized controlled trials (RCTs) and controlled clinical trials (CCTs) were considered for inclusion to ensure a higher level of evidence. Studies focusing on pediatric populations, observational designs, reviews, and non-English language publications were excluded. The methodological quality of included studies was assessed using established tools such as the Cochrane Risk of Bias Tool, with particular attention to randomization, allocation concealment, blinding, and attrition. In instances where multiple publications reported on the same study, the most comprehensive and recent data were included. Data extraction was performed independently by two reviewers using a standardized form, including information on study characteristics, participant demographics, intervention details, and blood pressure outcomes. Any discrepancies during the study selection, eligibility assessment, and data extraction processes were resolved through consensus or consultation with a third reviewer.

Results and discussion

Eight clinical trials met the inclusion criteria and were included in the systematic review. The selected trials collectively involved a diverse range of participants, with a combined sample size ranging from 322 to 2,564 individuals across the studies [10-17]. The characteristics of the patient populations varied, reflecting the heterogeneity of obesity and its associated comorbidities. One of the included trials, comprising 513 participants with a mean age of 45 years and a BMI range of 35-45 kg/m², investigated the impact of gastric bypass surgery compared to a comprehensive lifestyle intervention [10]. The study reported a statistically significant reduction in systolic blood pressure by an average of 12 mmHg and diastolic blood pressure by 8 mmHg in the surgical group compared to the lifestyle intervention group over a 12-month follow-up period. Another trial, involving 836 participants with a mean age of 50 years and a BMI range of 40-50 kg/m², compared the effects of sleeve gastrectomy to pharmacotherapy [14]. The sleeve gastrectomy group demonstrated a substantial decrease in systolic blood pressure by 15 mmHg and diastolic blood pressure by 10 mmHg compared to the pharmacotherapy group over a 24-month period [16].

In a smaller trial with 322 participants, aged 35-60 years with a BMI range of 30-40 kg/m², the study compared the effects of a low-calorie diet combined with pharmacotherapy to gastric banding surgery [5]. Results indicated a significant reduction in systolic blood pressure by 10 mmHg and diastolic blood pressure by 6 mmHg in the surgical group relative to the non-surgical group after 18 months. Across the included trials, the observed effects on blood pressure were consistent in demonstrating a greater reduction in both systolic and diastolic blood pressure in the surgical intervention groups compared to non-surgical interventions. The duration of follow-up ranged from 12 to 24 months across the studies.

The eight clinical trials included in this systematic review collectively suggest a favorable impact of surgical interventions, such as gastric bypass, sleeve gastrectomy, and gastric banding, on blood pressure outcomes compared to non-surgical approaches, including lifestyle interventions and pharmacotherapy. The observed reductions in blood pressure provide valuable insights into the potential cardiovascular benefits of surgical treatments for obesity, emphasizing the need for further research and exploration of long-term outcomes. The systematic review's comprehensive analysis of the eight included clinical trials has yielded valuable statistical findings that significantly contribute to the broader understanding of the impact of surgical and non-

surgical interventions on blood pressure outcomes in individuals with obesity. By delving into the statistical nuances of each study, this discussion aims to contextualize the results within the existing medical literature. The observed reductions in systolic and diastolic blood pressure across the studies underscore the robust cardiovascular benefits associated with surgical interventions [4, 5, 7, 10, 17]. Statistical significance, as indicated by p-values, further reinforces the reliability of these findings. For instance, a large-scale trial comparing gastric bypass to medical management, the observed reduction of 18 mmHg in systolic blood pressure and 12 mmHg in diastolic blood pressure was statistically significant ($p < 0.001$ and $p < 0.01$, respectively), emphasizing the clinical relevance of surgical interventions in achieving substantial and meaningful changes in blood pressure [10].

Comparing these results to the broader medical literature reveals consistency with previous findings. Individual studies within the literature have reported similar magnitudes of blood pressure reduction following bariatric surgery [18]. The observed reductions in systolic and diastolic blood pressure in this review align with those reported in studies exploring the cardiovascular benefits of specific surgical procedures. This consistency reinforces the robustness of the observed effects across different patient populations and interventions. Furthermore, the comparison of surgical interventions to non-surgical strategies in this review reflects a significant statistical advantage for surgery [19]. For instance, a study where sleeve gastrectomy was compared to pharmacotherapy, the surgical group exhibited a statistically significant reduction of 12 mmHg in systolic blood pressure and 7 mmHg in diastolic blood pressure ($p < 0.001$ and $p < 0.01$, respectively). These findings are in line with the broader literature, where surgical interventions consistently demonstrate superior efficacy in achieving significant blood pressure reductions compared to non-surgical approaches [4, 20]. However, it is crucial to note that statistical significance alone does not capture the clinical significance or long-term sustainability of these blood pressure reductions. While the included studies contribute valuable short to medium-term insights, the duration of follow-up remains a limiting factor in comprehensively understanding the enduring cardiovascular effects of these interventions [21, 22]. The findings from the systematic review align with and reinforce the existing medical literature, supporting the notion that surgical interventions offer a statistically significant and clinically meaningful advantage in reducing blood pressure in individuals with obesity. The consistency of these statistical outcomes across diverse interventions and patient populations highlights the robustness of the observed effects. Future research with extended follow-up periods and standardized outcome measures will be instrumental in further delineating the enduring cardiovascular benefits of surgical interventions compared to non-surgical strategies.

Conclusions

This systematic review, comprising eight clinical trials, provides compelling evidence supporting the superior impact of surgical interventions on blood pressure outcomes in individuals with obesity when compared to non-surgical approaches. The observed reductions in systolic and diastolic blood pressure, consistently significant across diverse patient populations and interventions, underscore the clinical relevance of bariatric surgery in addressing obesity-related hypertension. These findings align with and reinforce existing evidence in the medical literature, emphasizing the robustness and generalizability of the observed effects. The statistical advantage of surgical interventions, coupled with their potential to induce substantial and sustained weight loss, positions them as a crucial component in the comprehensive management of obesity-related cardiovascular risks.

Conflict of interests

The authors declared no conflict of interests.

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Table (1): Summary of the findings of the included clinical trials that compare the impact of bariatric surgery on blood pressure to other non-surgical interventions

Study ID	Sample Size	Population Characteristics	Intervention vs. comparison	Outcomes on blood pressure	Conclusions
Study 1	513	Mean age: 45, BMI: 35-45	Gastric Bypass vs. Lifestyle	↓ SBP: 12mmHg ($p < 0.001$), ↓ DBP: 8mmHg ($p < 0.01$)	Surgical intervention significantly reduced BP compared to lifestyle at 12 months.
Study 2	803	Mean age: 50, BMI: 40-50	Sleeve Gastrectomy vs. Pharmacotherapy	↓ SBP: 15mmHg ($p < 0.001$), ↓ DBP: 10mmHg ($p < 0.01$)	Sleeve gastrectomy led to substantial BP reduction compared to pharmacotherapy over 24 months.
Study 3	322	Age: 35-60, BMI: 30-40	Gastric Banding vs. Diet + Pharmacotherapy	↓ SBP: 10mmHg ($p < 0.05$), ↓ DBP: 6mmHg ($p < 0.01$)	Gastric banding resulted in a significant BP decrease compared to non-surgical interventions at 18 months.
Study 4	1276	Mean age: 55, BMI: 35-45	Lifestyle Modification vs. Gastric Bypass	↓ SBP: 8mmHg ($p < 0.05$), ↓ DBP: 5mmHg ($p < 0.01$)	Gastric bypass and lifestyle modification both reduced BP, with a slightly greater effect in the surgical group.
Study 5	696	Mean age: 48, BMI: 35-50	Pharmacotherapy vs. Gastric Sleeve	↓ SBP: 12mmHg ($p < 0.001$), ↓ DBP: 7mmHg ($p < 0.01$)	Gastric sleeve surgery resulted in a more significant BP reduction compared to pharmacotherapy over 18 months.
Study 6	412	Age: 40-65, BMI: 35-40	Lifestyle + Pharmacotherapy vs. Gastric Bypass	↓ SBP: 14mmHg ($p < 0.001$), ↓ DBP: 9mmHg ($p < 0.01$)	Gastric bypass demonstrated superior BP reduction compared to combined lifestyle and pharmacotherapy at 12 months.
Study 7	2564	Mean age: 52, BMI: 40-55	Gastric Bypass vs. Medical Management	↓ SBP: 18mmHg ($p < 0.001$), ↓ DBP: 12mmHg ($p < 0.01$)	Gastric bypass exhibited a profound BP reduction compared to medical management over a 24-month period.
Study 8	350	Age: 30-50, BMI: 30-35	Pharmacotherapy vs. Sleeve Gastrectomy	↓ SBP: 13mmHg ($p < 0.001$), ↓ DBP: 8mmHg ($p < 0.01$)	Sleeve gastrectomy resulted in a significant BP reduction compared to pharmacotherapy over a 12-month period.


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