



**FACULDADE DE CIÊNCIAS HUMANAS, EXATAS E DA SAÚDE DO PIAUÍ
INSTITUTO DE EDUCAÇÃO SUPERIOR DO VALE DO PARNAÍBA
COORDENAÇÃO DO CURSO DE MEDICINA**

**EDVALDO PEREIRA DE MOURA FILHO
MATEUS NUNES CARVALHO**

**EMBOLOGIZAÇÃO DE RAMOS DA ARTÉRIA GÁSTRICA ESQUERDA PARA
REDUÇÃO DE APETITE E PERDA DE PESO EM PACIENTES OBESOS**

**PARNAÍBA - PIAUÍ
JUNHO - 2019**

EDVALDO PEREIRA DE MOURA FILHO
MATEUS NUNES CARVALHO

**EMBOLOGIZAÇÃO DE RAMOS DA ARTÉRIA GÁSTRICA ESQUERDA PARA
REDUÇÃO DE APETITE E PERDA DE PESO EM PACIENTES OBESOS**

Trabalho de conclusão de curso
apresentado ao Curso de Medicina da
FAHESP/IESVAP, como requisito para
obtenção do Grau de Bacharel em
Medicina.

Orientador: Prof. MSc. Luan Kelves
Miranda de Souza

**PARNAÍBA - PIAUÍ
JUNHO – 2019**

Moura Filho, Edvaldo Pereira de; Carvalho, Mateus
Nunes

M929e

Embolização de ramos da artéria gástrica esquerda
para redução de apetite e perda de peso em pacientes
obesos / Edvaldo Pereira de Moura Filho; Mateus
Nunes Carvalho. - Parnaíba. - 2019.

71 f.: il.

Monografia apresentada ao Instituto de
Educação Superior do Vale do Parnaíba – IESVAP,
Parnaíba-PI, para graduação em Medicina, 2019.

Orientador: Prof.º Mestre Luan Kelves
Miranda de Souza.

1. Nutrição. 2. Obesidade. I. Título.

CDU 612.39

EDVALDO PEREIRA DE MOURA FILHO
MATEUS NUNES CARVALHO

**EMBOLOGIZAÇÃO DE RAMOS DA ARTÉRIA GÁSTRICA ESQUERDA PARA
REDUÇÃO DE APETITE E PERDA DE PESO EM PACIENTES OBESOS**

Trabalho de conclusão de curso
apresentado ao Curso de Medicina da
FAHESP/IESVAP, como requisito para
obtenção do Grau de Bacharel em
Medicina.

APROVADO EM ____/____/____

BANCA EXAMINADORA:

Prof. MSc. Luan Kelves Miranda de Souza
Biomédico, mestre em biotecnologia, doutorando em biotecnologia
(Orientador)

Dr. Ramodnil de Moura Santos
Médico Gastroenterologista, Preceptor de Saúde do Adulto e do Idoso do IESVAP

Mário Abel Lima Barros
Farmacêutico, especialista em análises clínicas, professor do IESVAP

**PARNAÍBA - PIAUÍ
JUNHO - 2019**

*“Pouco conhecimento faz com que
as pessoas se sintam orgulhosas.
Muito conhecimento, que se sintam humildes.
É assim que as espigas sem grãos
erguem desdenhosamente a cabeça para o Céu,
enquanto que as cheias as baixam para a terra, sua mãe”*
Leonardo da Vinci

RESUMO

A obesidade é uma doença caracterizada pelo acúmulo excessivo de gordura corporal em um nível que compromete a saúde dos indivíduos e está associado ao desenvolvimento de doenças crônicas. A abordagem atual para o tratamento da obesidade é a modificação da dieta, instituição de atividade física, farmacoterapia seguida ou não de cirurgia bariátrica. Embora a cirurgia tenha mostrado resultados positivos em relação à perda de peso e reversão de comorbidades, o alto custo, a invasividade, o risco de mortalidade e a restrição da população capaz de realizar o procedimento, induzem pesquisas para terapias menos agressivas. Como alternativa, um procedimento endovascular minimamente invasivo para o tratamento da obesidade é a embolização de ramos da artéria gástrica esquerda, a fim de promover a supressão do hormônio grelina. Demonstrou-se que este peptídeo produzido no fundo do estômago é um potente estimulador do apetite e comunica o sistema gastrointestinal ao cérebro no organismo, promovendo regulação da ingestão de alimentos e do gasto de energia. O objetivo deste trabalho é analisar os estudos pré-clínicos, clínicos e retrospectivos publicados para avaliar a segurança, a eficácia, os efeitos colaterais, os níveis de grelina e a perda de excesso de peso alcançada após o seguimento em um período. As publicações científicas foram pesquisadas nas bases de dados PubMed, Medline, CINHALL, Scopus, Cochrane e SCIELO de fevereiro de 1999 a fevereiro de 2019 e foram incluídos 16 estudos. Pode ser muito cedo para comparar a eficácia dessa técnica com a cirurgia bariátrica, pois os relatos atuais descrevem apenas a experiência com um número limitado de pacientes com durações de seguimento relativamente curtas. Além disso, a variabilidade entre esses estudos é alta. Preocupações foram levantadas em estudos iniciais de esvaziamento gástrico retardado que pode ocorrer após este procedimento o que precisaria ser mais formalmente avaliado. Uma vez estabelecido um perfil de segurança aceitável, estudos prospectivos, multicêntricos, randomizados podem ser realizados.

PALAVRAS-CHAVE: cirurgia bariátrica; embolização; obesidade; perda de peso.

ABSTRACT

Obesity is a disease characterized by excessive accumulation of body fat at a level that compromises the health of individuals and is associated with the development of chronic diseases. The current approach for the treatment of obesity is diet modification, institution of physical activity, pharmacotherapy followed or not by bariatric surgery. Although surgery has shown positive results in relation to weight loss and reversal of comorbidities, high cost, invasiveness, mortality risk and restriction of the population able to perform the procedure, induces researches for less aggressive therapies. As an alternative, an endovascular minimally invasive procedure for the treatment of obesity is the embolization of branches of the left gastric artery, in order to promote the suppression of the hormone ghrelin. This peptide produced in the stomach fundus has been shown to be a potent stimulator of appetite and it communicates the gastrointestinal system to the brain in the regulation of food intake and energy expenditure. The objective of this literature review is to analyze the preclinical, clinical and retrospective studies published to assess the safety, efficacy, side effects, ghrelin levels and the excess weight loss achieved after follow-up over a period. Scientific publications were searched in PubMed, Medline, CINHALL, Scopus, Cochrane and SCIELO databases from February 1999 to February 2019 and 16 studies was included. It may be too early to compare the efficacy of this technique with bariatric surgery, as current reports describe only the experience with a limited number of patients with relatively short follow-up durations. In addition, the variability between these studies is high. Concerns were raised in early studies of delayed gastric emptying that may occur after this procedure. This would need to be more formally evaluated. Once an acceptable safety profile is established, prospective, multicenter, randomized trials may be performed.

Key words: bariatric surgery, embolization, ghrelin, obesity, weight loss.

SUMÁRIO

1	INTRODUÇÃO.....	08
2	REFERENCIAL TEÓRICO.....	11
3	OBJETIVOS.....	14
3.1	Objetivos gerais.....	14
3.2	Objetivos específicos.....	14
4	METODOLOGIA.....	15
4.1	Fluxograma de pesquisa.....	16
5	ARTIGO CIENTÍFICO.....	17
6	CONSIDERAÇÕES FINAIS.....	46
7	REFERÊNCIAS BIBLIOGRÁFICAS.....	47
8	ANEXOS.....	53
8.1	Normas de Submissão.....	53
8.2	Comprovante de Submissão.....	70

1 INTRODUÇÃO

A obesidade é definida como o peso corporal desproporcional à altura com acúmulo excessivo de tecido adiposo, geralmente associado à inflamação sistêmica (WILLIAMS et al., 2015). De etiologia multifatorial, envolve interações complexas entre genes, hormônios, meio ambiente, estilo de vida e está associada ao desenvolvimento de doenças crônicas como diabetes mellitus tipo 2, hipertensão arterial, dislipidemia, entre outras (GONZÁLEZ-MUNIESA et al., 2017).

Trata-se de uma doença crônica de prevalência ascendente. O número de pessoas obesas no mundo triplicou desde 1975, totalizando cerca de 650 milhões de pessoas, acometendo 13% da população adulta (OMS, 2016). Em resposta à obesidade e suas complicações, numerosas estratégias foram defendidas na tentativa de diminuir a sua progressão, a exemplo de mudanças no estilo de vida, tratamento cirúrgico e farmacológico.

As intervenções de estilo de vida tentam atuar no controle de massa corporal, considerando consumo, gasto de energia e deposição de gordura (GONZÁLEZ-MUNIESA et al., 2017). Estratégias, a começar pela dieta e prática de atividades físicas são utilizadas como tratamento de primeira linha para reverter a obesidade (FLEGAL, 2010). No entanto, pode-se notar que os resultados desta conduta estão abaixo do controle da epidemia.

As opções cirúrgicas têm sido adotadas como uma abordagem mais invasiva e efetiva, buscando a perda de peso, melhoria das comorbidades e da qualidade de vida. Contudo, os benefícios da cirurgia são contrabalanceados pelos aspectos negativos precoces, que incluem infecções pós-operatórias, náuseas, vômitos, e pelos aspectos tardios, que podem levar à má-absorção de vitaminas e sais minerais (STEFATER; KOHLI; INGE, 2013).

O tratamento farmacológico tem encontrado dificuldades: a baixa quantidade de drogas disponíveis, as quais, no Brasil, somente três foram aprovadas - Sibutramina, Orlistat e Liraglutida (ABESO, 2016); a eficácia limitada, devido à perda de peso manter-se apenas enquanto o fármaco está sendo administrado e a elevada quantidade de efeitos colaterais desses medicamentos (GLANDT, 2011).

Durante as últimas décadas, muito foi estudado sobre o papel do estômago como órgão endócrino e sua função no controle homeostático (WREN, 2007). Embora uma grande quantidade de hormônios que limitam a ingestão de alimentos

(anorexígenos) tenha sido descoberta recentemente, o hormônio grelina tem o efeito oposto (orexígeno) (VAIRAVAMURTHY et al., 2017).

A concentração plasmática desse peptídeo é elevada antes das refeições e cai pós-prandialmente, sugerindo um papel regulador do apetite e da homeostase energética (CUMMINGS, 2006). As células produtoras de grelina estão localizadas no fundo gástrico (TAKIGUCHI et al., 2012). O suprimento vascular que irriga esta porção do estômago provém, predominantemente, de ramos que surgem da artéria gástrica esquerda (GREGORCZYK; AGNIESZKA, 2015).

Ao embolizar esses ramos, pode haver redução do suprimento sanguíneo para a região e, conseqüentemente, diminuir os níveis séricos de grelina o que pode modificar o equilíbrio homeostático de ingestão energética (MADOFF, 2013). A embolização é uma técnica terapêutica minimamente invasiva guiada por imagem e que visa a oclusão endovascular intencional de artérias e veias (VAIDYA; TOZER; CHEN, 2008).

A obesidade está intimamente ligada a sintomas físicos, psicológicos e a limitações funcionais, que têm impacto substancial e negativo na qualidade de vida. (YOUNG; NESTLE, 2002). É uma epidemia global cada vez maior que apresenta um grande fardo para os cuidados da população acometida nos sistemas de saúde devido a sua associação com problemas crônicos.

Algumas das complicações mais conhecidas relacionadas ao excesso de peso incluem resistência à insulina, Diabetes Mellitus tipo 2, hipertensão arterial sistêmica, dislipidemia e doenças cardiovasculares. Além dessas, também são citadas apneia obstrutiva do sono, doença hepática gordurosa não alcoólica, osteoartrite, síndrome dos ovários policísticos, câncer e doenças psicológicas (POZZA; ISIDORI, 2017).

A abordagem atual para o tratamento da obesidade é a modificação da dieta, instituição de exercício físico, farmacoterapia seguido ou não de encaminhamento para cirurgia bariátrica (NGUYEN et al., 2012). Embora a cirurgia tenha mostrado resultados positivos em relação à perda de peso e a reversão de comorbidades, o alto custo, a invasividade, o risco de mortalidade e a restrição da população apta a realizar o procedimento (PORIES, 2008), induz a busca por terapias menos agressivas.

A grelina é atualmente conhecida como um potente estimulador de apetite (TYMITZ et.al, 2011). Ela comunica o sistema gastrointestinal ao cérebro na regulação da ingestão de alimentos e gasto energético (LEE et al., 2002). É produzida em

resposta à fome, servindo, portanto, como sinal que orienta o sistema nervoso central a estimular a ingesta alimentar (KOJIMA, 2005).

Estudos têm mostrado associação entre a grelina e a obesidade, com aumento do apetite e do tecido adiposo após a administração desse peptídeo. (CUMMINGS et al., 2001; TSCHÖP, 2000). O fundo do estômago recebe suprimento através da artéria gástrica esquerda, ramo do tronco celíaco e produz cerca de 90% do volume de grelina circulante (KOJIMA et al., 1999).

Recentemente, tem-se sugerido que a embolização da artéria gástrica esquerda por cateter poderia ajudar a controlar os níveis sistêmicos de grelina e potencialmente influenciar na diminuição da ingestão de alimentos (WOLF; PARK; SISKIN, 2014). Entretanto são necessários estudos que levem a uma melhor compreensão de como esse procedimento leva a redução hormonal, da segurança do procedimento, seguimento a longo prazo desses pacientes e comparação com resultados obtidos em outras formas de tratamento.

Diante da crescente prevalência da obesidade e das várias possibilidades de escolhas para o tratamento, ineficazes na regressão desta epidemia, busca-se avaliar a eficácia do uso da Embolização de ramos da artéria gástrica esquerda para redução dos níveis circulantes de grelina na tentativa de reduzir apetite e diminuir o peso, sendo uma nova estratégia no combate à obesidade.

A embolização poderia ser usada como procedimento autônomo no controle da obesidade pela redução da grelina ou como alternativa menos invasiva em associação a mudanças no estilo de vida e tratamentos farmacológicos.

Com esse estudo se espera conhecer as vantagens e desvantagens da embolização gástrica, as facilidades e dificuldades encontradas pelos radiologistas intervencionistas na execução do procedimento, bem como comparar seus resultados e sua relevância com outras alternativas terapêuticas utilizadas atualmente.

Por se tratar de uma técnica endovascular minimamente invasiva, os pacientes que forem submetidos ao procedimento possivelmente não necessitarão de internação. O custo para os órgãos públicos será menor e um maior número de pacientes pode ser atingido.

2 REFERENCIAL TEÓRICO

A obesidade é uma doença caracterizada pelo acúmulo excessivo de gordura corporal em um nível que compromete a saúde dos indivíduos (WHO, 2000), estando associada a morbidades como diabetes tipo 2, hipercolesterolemia, hipertensão, ataque cardíaco, acidente vascular encefálico, apneia obstrutiva do sono, asma, osteoartrite, flebite, gota, síndrome do ovário policístico, infertilidade, depressão e câncer (GONZÁLEZ-MUNIESA et al., 2017).

O diagnóstico da obesidade é realizado a partir do índice de massa corporal(IMC), parâmetro estipulado pela Organização Mundial de Saúde, obtido a partir da relação entre peso corpóreo (kg) e estatura (m) dos indivíduos. Através deste parâmetro são considerados obesos os indivíduos, cujo IMC encontra-se num valor igual ou superior a 30 kg/m² (WHO, 2000).

O crescimento global do índice de massa corporal (IMC) aumentou a morbimortalidade associada à obesidade, o que tem levado a uma epidemia de saúde pública (FINUCANE et al., 2011). As principais abordagens terapêuticas para a obesidade incluem modificações no estilo de vida, intervenção cirúrgica e farmacoterapia.

Modificações no estilo de vida, incluindo dieta e atividade física, podem ser benéficas para pacientes com sobrepeso (IMC entre 25 e 29,9) e pacientes com obesidade leve (IMC entre 30 e 34,9). Em média, pode ser atingida uma perda de peso de 5 a 10% (JONES; WILSON; WADDEN, 2007), no entanto, aqueles que praticam apenas modificação do estilo de vida não têm mostrado perda de peso sustentada (ARONNE et al., 2009; CAWLEY; MEYERHOEFER, 2012).

Medidas mais agressivas, como a cirurgia bariátrica (derivação gástrica em Y-de-Roux, banda gástrica ajustável e gastrectomia vertical), são reservadas para indivíduos obesos mórbidos (definidos como IMC maior ou igual a 40) ou obesos com um IMC acima de 35 e comorbidade relacionada à obesidade (CAMPOS et al., 2016).

Complicações pós-operatórias, como vazamento de anastomose, intussuscepção e cálculos biliares, diminuíram com o advento das técnicas laparoscópicas, contudo, quando ocorrem, podem ser gravemente debilitantes para o paciente, resultando em aumento de morbidade e mortalidade (REOCH, 2011; BAPTISTA; WASSEF, 2013).

A abordagem mais bem-sucedida para perda de peso do obeso tem sido a cirurgia bariátrica (VIX et al., 2012; VIX et al., 2013), todavia, devido à invasividade,

custo e possível morbidade associada a esse procedimento, são estimuladas pesquisas de novas alternativas que sejam menos invasivas (BENNETT; MEHTA; RHODES, 2007).

Alguns exemplos incluem terapias endoscópicas como balão intragástrico, plicatura gástrica endoscópica, gastroplastia de manga endoscópica, bem como estimuladores elétricos gástricos (KUMAR; THOMPSON, 2011). Esses métodos demonstraram ser mais eficazes que as mudanças de estilo de vida, com menor risco de complicações que a cirurgia bariátrica e estão em processo de avaliação para determinar a segurança a longo prazo (VERDAM et al., 2012).

Existem ainda três medicamentos aprovados para tratamento da obesidade no Brasil: sibutramina, orlistate e liraglutida. A farmacoterapia atualmente é uma terapia adjunta, não sendo um dos pilares da gestão da obesidade. A modulação farmacológica da fome poderia fornecer uma solução para essa epidemia; contudo, os candidatos a fármacos atualmente disponíveis mostram uma variação modesta de perda de peso (ABESO, 2016).

Até o momento, o uso desses medicamentos pode promover uma perda de peso com intervalo de 2,0 a 6,5 kg, portanto, agem principalmente como um complemento às modificações no estilo de vida (CUMMINGS et al., 2002). Além disso, a adesão a longo prazo à terapia medicamentosa continua sendo um desafio constante, devido ao alto custo e aos efeitos adversos consideráveis associados a essa terapia (ABESO, 2016; MAAHS et al., 2006; COUTINHO et al., 2013).

Como alternativa, surge um procedimento minimamente invasivo para o tratamento da obesidade: a embolização de ramos da artéria gástrica esquerda. O conceito por trás desta técnica baseia-se nos efeitos hormonais da cirurgia bariátrica (WEISS et al., 2015).

A razão para a embolização bariátrica como alvo no tratamento da obesidade surge do papel da grelina, um peptídeo de 28 aminoácidos (KOJIMA et al., 1999), secretado principalmente a partir do fundo do estômago (90%) (WREN; BLOOM, 2007). Atua no estímulo do apetite e induz a fome, aumentando a ingesta alimentar e resulta em ganho de peso (CUMMINGS; OVERDUIN, 2007).

Os níveis plasmáticos de grelina aumentam significativamente antes das refeições (induzindo a fome) e diminuem após a alimentação (como parte da resposta à saciedade), o que a caracteriza como um hormônio orexígeno (WREN et al., 2001; CUMMINGS et al., 2001).

No entanto, os níveis de grelina não reduzem quando o paciente obeso se alimenta, o que pode contribuir para os excessos (ENGLISH et al., 2002). Além disso, esse peptídeo pode ser parcialmente responsável pela perda de peso após a realização da cirurgia bariátrica (CUMMINGS et al., 2002).

Ao criar isquemia principalmente no fundo gástrico, a Embolização bariátrica visa atingir as células produtoras de grelina a fim de diminuir seus níveis plasmáticos e, assim, reduzir a fome contribuindo para a perda de peso em pacientes obesos (WEISS; KATHAIT, 2017).

3 OBJETIVOS

3.1 Objetivos gerais

- Avaliar a embolização de ramos da artéria gástrica esquerda para redução de apetite e perda de peso em pacientes obesos

3.2 Objetivos específicos

- Interpretar estudos acerca de vias hormonais presentes na obesidade;
- Comparar a embolização gástrica com a cirurgia bariátrica;
- Verificar os níveis séricos de grelina antes e depois do procedimento de embolização;
- Documentar a evolução da técnica de embolização bariátrica e os resultados obtidos;
- Discutir o potencial da embolização gástrica como opção de tratamento adjuvante em pacientes com obesidade mórbida;

4 METODOLOGIA

Trata-se de uma revisão de literatura sistemática, na qual foram pesquisadas publicações científicas nas bases de dados *Medical Literature Analysis and Retrieval System Online*(MEDLINE), *Excerpta Medica Database* (EMBASE) e *Scientific Electronic Library Online*(SCIELO). Foram utilizados os descritores em português "artéria gástrica", "embolização", "perda de peso", "obesidade", "cirurgia bariátrica" e "grelina". Em inglês os descritores foram "*gastric artery*", "*weight loss*", "*obesity*", "*bariatric surgery*" e "*ghrelin*".

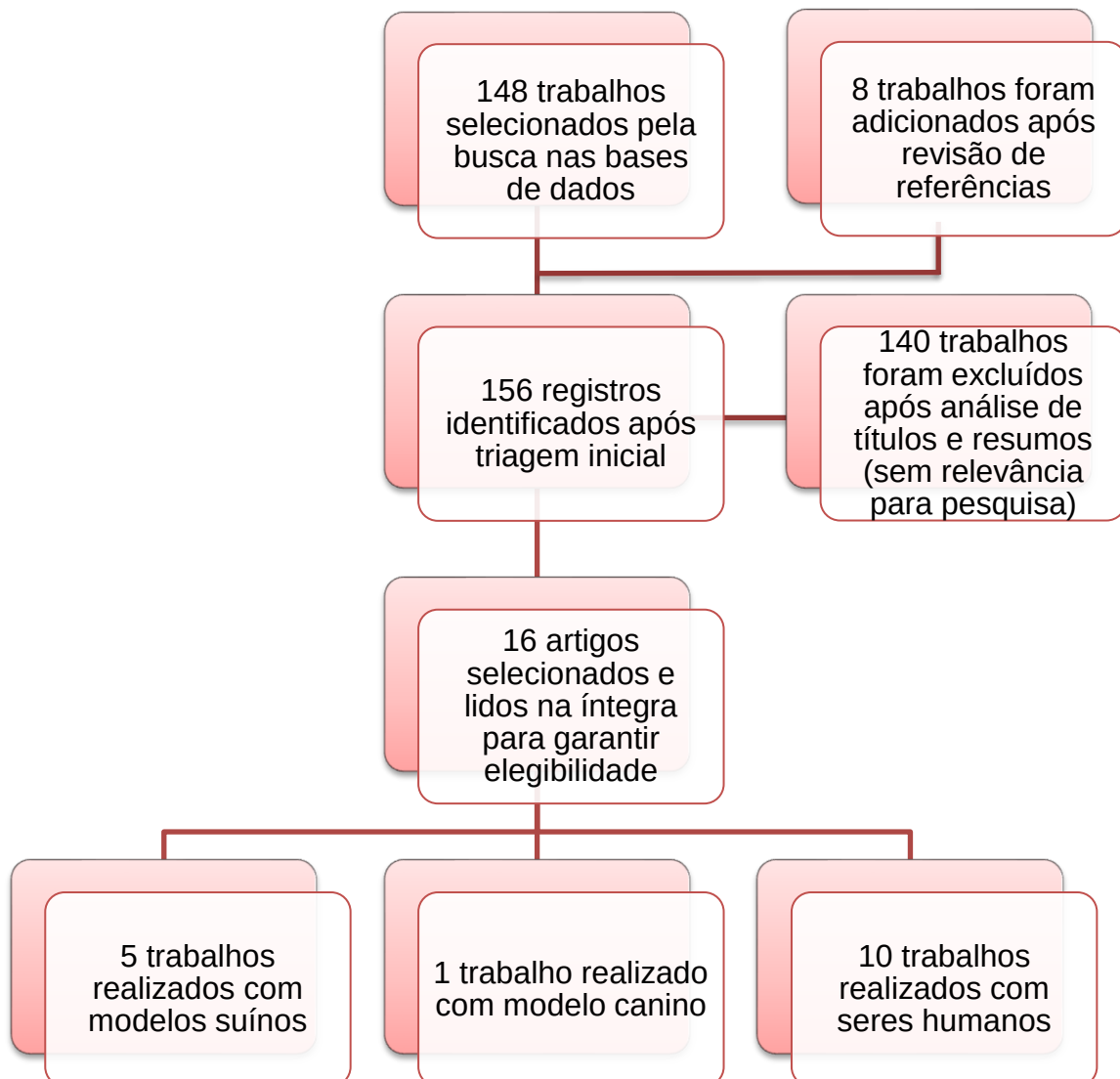
As referências dos artigos encontrados passaram por uma revisão manual para verificação de relevância e inclusão de estudos. Além disso, revistas do campo foram selecionadas para futura publicação da pesquisa.

Estudos que relatam o efeito da embolização da artéria gástrica objetivando perda de peso, tecido adiposo ou grelina sérica serão elegíveis. Uma vez que o conceito de embolização da artéria gástrica é pouco estudado e pouco publicado, pouca restrição foi aplicada à linguagem, assunto ou projeto do estudo.

Dos artigos selecionados, foram analisados o tipo de estudo, forma e local de intervenção, presença de um grupo controle ou procedimento simulado, tipo de embolização, vasos alvo, medidas de resultado (concentração de grelina, alteração de peso, alteração de gordura subcutânea ou medidas de outros parâmetros laboratoriais), complicações pós-procedimento e duração do seguimento.

Um total de 148 registros foram identificados pela triagem inicial após busca nas bases de dados e revisão de referências. Os títulos e resumos foram analisados por todos os integrantes individualmente. Destes trabalhos, apenas 16 remaneceram para compor a pesquisa, os quais tiveram todo seu texto lido para garantir a elegibilidade. Os selecionados dividem-se em trabalhos realizados com animais (cinco com modelos suínos e um modelo canino) e trabalhos realizados com seres humanos (dez publicações).

4.1 Fluxograma de pesquisa



5 ARTIGO CIENTÍFICO

Elsevier Editorial System(tm) for Surgery
for Obesity and Related Diseases

Manuscript Draft

Manuscript Number: SOARD-19-238

Title: LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR APPETITE
SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS

Article Type: Review Article

Keywords: bariatric surgery; embolization; ghrelin; obesity; weight loss.

Corresponding Author: Mr. Mateus Nunes Carvalho,

Corresponding Author's Institution:

First Author: Mateus Nunes Carvalho

Order of Authors: Mateus Nunes Carvalho; Edvaldo P Moura Filho; Igor
Matheus O Silva; Raíssa P Nery; Luan K Souza, MSc. , PhD. Student

Abstract: Obesity is a disease characterized by excessive accumulation of body fat at a level that compromises the health of individuals and is associated with the development of chronic diseases. The current approach for the treatment of obesity is diet modification, institution of physical activity, pharmacotherapy followed or not by bariatric surgery. Although surgery has shown positive results in relation to weight loss and reversal of comorbidities, high cost, invasiveness, mortality risk and restriction of the population able to perform the procedure, induces researches for less aggressive therapies. As an alternative, an endovascular minimally invasive procedure for the treatment of obesity is the embolization of branches of the left gastric artery, in order to promote the suppression of the hormone ghrelin. This peptide produced in the stomach fundus has been shown to be a potent stimulator of appetite and it communicates the gastrointestinal system to the brain in the regulation of food intake and energy expenditure. The objective of this literature review is to analyze the preclinical, clinical and retrospective studies published to assess the safety, efficacy, side effects, ghrelin levels and the excess weight loss achieved after follow-up over a period. Scientific publications were searched in PubMed, Medline, CINHALL, Scopus, Cochrane and SCIELO databases from February 1999 to February 2019 and 15 studies was included. It may be too early to compare the efficacy of this technique with bariatric surgery, as current reports describe only the experience with a limited number of patients with relatively short follow-up durations. In addition, the variability between these studies is high. Concerns were raised in early studies of delayed gastric emptying that may occur after this procedure. This would need to be more formally evaluated. Once an acceptable safety profile is established, prospective, multicenter, randomized trials may be performed.

Cover Letter

Mateus Nunes Carvalho

Fourth-year undergraduate student in medicine at the Faculty of Human, Health, Exact Sciences of Piauí and Higher Education Institute of Vale do Parnaíba, PI, Brazil. Founding member and former president of the Academic League of Clinical Anatomy and Imaging Diagnostics of Piauí.

Conviver Parnaíba Residence , Q10C14
Parnaíba, PI, Brazil
Bairro João XXIII – CEP 64205-030
Email: mateusnunes@gmail.com

1st May, 2019

Dear Editor,

I am pleased to submit an original research article entitled “**Left gastric artery embolization as an alternative for appetite suppression and weight loss in obese patients**” by Edvaldo Pereira de Moura Filho, Igor Matheus Oliveira da Silva, Raíssa Pinheiro Nery, Luan Kelves Miranda de Souza and My Name for consideration for publication in *Surgery for obesity and related diseases*.

In this manuscript, by means of a literature review we analysed the preclinical, clinical and retrospective studies published to assess the safety, efficacy, side effects, ghrelin levels and the mean weight loss achieved after follow-up over a period. This is significant because is an alternative for the treatment of obesity, since it is a minimally invasive procedure based on the hormonal effects of bariatric surgery and could be used to overweight patients who were not candidates for bariatric surgery.

We believe that this manuscript is appropriate for publication by **Surgery for obesity and related diseases** because it shows the effects of a surgically technique that induce a weight loss on obesity.

This manuscript has not been published anywhere (including electronic media) and is not under consideration for publication elsewhere. We have no conflicts of interest to disclose either.

Please address all correspondence concerning this manuscript to me at
mateusnunes@gmail.com

Thank you for your consideration of this manuscript.

Sincerely,

Mateus Nunes Carvalho



Author Disclosure**SURGERY FOR OBESITY AND RELATED DISEASES (SOARD)**
Author Disclosure of Relevant Financial Relationships**NAME: MATEUS NUNES CARVALHO****TITLE OF ARTICLE: LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR APPETITE SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS**

The **American Society for Metabolic and Bariatric Surgery** must ensure that anyone who is in a position to control the content of the education activity has disclosed to us all relevant financial relationships with any commercial interest (see below for definitions).

Please indicate below any commercial interests that would pertain to the content of the article being submitted to SOARD.

☒
☐
☐

None of the authors have anything to disclose (if you are the corresponding author).

I do not have anything to disclose (if you are an individual author).

I am disclosing all relevant financial relationships with any commercial interests that pertain to this article (see below).

Checklist

Checklist

GENERAL

✓ Potential conflicts of interest, whether of a financial or other nature related to the topic of the manuscript, are disclosed by checking the appropriate box on the author agreement form and listing the potential conflicts in an attachment to the author agreement form.

In addition, the manuscript itself must include a Disclosure Statement in which every author must list any financial or personal relationships that could inappropriately bias the work.

✓ Pages are numbered consecutively

✓ I certify that the manuscript did not involve the use of animal or human subjects

✓ Lines are numbered consecutively at 5 line intervals throughout the manuscript using the line numbering feature available in word processing software.

✓ The article is typed in 12-point type, double-spaced with one-inch margins

✓ Title page is uploaded separately (see below for title page requirements)

✓ No author or institutional information in the manuscript text

✓ Article is written in American English (e.g. anesthesia rather than anaesthesia)

✓ Unless a multicenter study, there are no more than 6 co-authors on an Original Manuscript and no more than 3 on a Case Report. Your article will be automatically rejected without review unless you have **VERY STRONG EVIDENCE** that more than 6 authors are necessary.

✓ Only the following abbreviations will be accepted: RYGB or LRYGB for Roux-en-Y Gastric Bypass or Laparoscopic RYGB; BPD for Biliopancreatic Diversion and for BPD with Duodenal Switch, BPD/DS; LAGB for laparoscopic adjustable gastric band; SG for Sleeve Gastrectomy

□ ALL abbreviations (including BMI) are defined when first presented in both the abstract and the manuscript

✓ Weight loss must be expressed as change in BMI, **AS WELL AS** % Excess Weight Loss (%EWL), with the calculation of ideal body weight as that equivalent to a BMI of 25 kg/m² and/or % Excess BMI Lost (%EBMIL) with excess BMI > 25 kg/m² **AS WELL AS** % total body weight loss

✓ Each manuscript requires a Conclusions paragraph. Prior to this paragraph, there needs to be a presentation of the limitations of the study

✓ Following the Conclusion paragraph there needs to be a disclosure of all conflicts of interest or, if none, so state.

COVER LETTER

✓ A cover letter is submitted indicating the intent to submit to *Surgery for Obesity and Related Diseases*.

✓ Publication elsewhere (including electronic media) of any of the material in the manuscript submitted, other than an abstract of not more than 300 words, is identified and a copy of the other publication is submitted to the editorial office.

TITLE PAGE

✓ The title, author name(s) and major degree(s), affiliation(s), and the source(s) of funding for the work or study are provided.

✓ The name, address, telephone and fax numbers, and e-mail address of the corresponding author are given.

✓ The manuscript title is no longer than 150 characters (letters and spaces) and does not contain any abbreviations or acronyms.

✓ A short title (no more than 50 characters) is provided at the bottom of the page for use as a running foot.

✓ The only acknowledgments are of financial or other substantive assistance. All individuals named in the acknowledgments have given written permission to be named.

ABSTRACT (for original and review articles only)

✓ For original research reports and review articles, the abstract is limited to 250 and 300 words, respectively, and in the case of original articles follows the appropriate structured abstract format. **Review articles do not require a structured format.** Abstracts are not used in Case reports, Controversial Issues, Surgeon at Work and Updates.

✓ If the research identified important variables that lacked statistical difference, the study's power to detect such difference is addressed in the abstract.

✓ Footnotes, references, and commercial names are not used in the abstract.

✓ The abstract precedes the manuscript document.

✓ Keywords are added at the end.

REFERENCES

✓ References correspond to the specifications of the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals." Examples of specific types of references are available at:

http://www.elsevier.com/wps/find/journaldescription.cws_home/703772/authorinstructions

✓ References are identified on the line within parentheses **in superscript**, e.g. Schauer et al. ⁽³⁾.

✓ Each reference is cited in the text.

✓ References are double-spaced and are **numbered consecutively** in the order in which they appear in the text.

✓ ALL authors have been listed when 6 or less. Only when more than 6, should the first 3 authors be listed followed by "et al."

□ Unpublished data, personal communications, submitted manuscripts, statistical programs, papers presented at meetings, and non-peer-review publications are not listed in the reference list.

TABLES

☐ Each table is on a separate sheet of paper with its title and uploaded separately from the manuscript.

☒ Tables are numbered with Arabic numerals, e.g. Table 1, Table 2.

☒ Each table contains all necessary information in order that it may stand alone, independent of the text, including definitions of all abbreviations in the table in a legend beneath the table.

☒ No table repeats all data presented in the text.

FIGURES

☒ Digital art guidelines and artwork checklist on the journal's web site (http://www.elsevier.com/framework_authors/Artwork/Artwork_2010.pdf) have been consulted.

☒ Each figure is cited in the text.

☒ Figures have a minimum width of 3¼ inches and height of 2 inches.

☐ Images are submitted in TIFF (Tagged Image File Format) or EPS (Encapsulated PostScript) formats

☒ Letters and identifying marks (e.g. arrows) are clear and sharp, and the critical areas of radiographs and photomicrographs are identified. **All figures and edited tables use at least 300 DPI**

☒ **Figures and tables are of high quality and sufficient size and clarity for reproduction in the journal**

☒ All text that may identify a patient, including initials of the patient's name) is removed.

☒ Explanatory material appears in the accompanying legend and not on the figure itself, including definitions of all abbreviations in the figure in a legend beneath the table.

☒ Legends are listed on one page at the end of the manuscript and must have definitions for all abbreviations.

☐ Each figure is uploaded separately from the manuscript

☒ I understand that color figures are welcome and will appear in color on the web at no extra charge; however, there is a charge for the reproduction of color illustrations in print (\$650 for the first color figure and \$100 for each additional color figure) unless you request an exception and it is waived by the Editor and Publisher. Alternatively, the illustrations can be reproduced in print in black and white at no extra charge. Be sure that charts and graphs have been designed with this in mind so that the data are clear when published in black and white, i.e. different formats for the different columns (clear, hash marks, stippled, etc.) or graphic lines (solid, dashed, dotted, etc.).

Title Page

1

LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR APPETITE SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS

Mateus Nunes Carvalho^{1,3}, Edvaldo Pereira de Moura Filho^{1,3}, Igor Matheus Oliveira da Silva^{1,3}, Raíssa Pinheiro Nery^{2,3}, Luan Kelves Miranda de Souza⁴

5

¹Fourth-year undergraduate student in medicine at the Faculty of Human, Health, Exact Sciences of Piauí and Higher Education Institute of Vale do Parnaíba, PI, Brazil.

²Third-year undergraduate student in medicine at the Faculty of Human, Health, Exact Sciences of Piauí and Higher Education Institute of Vale do Parnaíba, PI, Brazil.

10 ³Academic League of Clinical Anatomy and Imaging Diagnostics of Piauí

⁴Professor at the Faculty of Human, Health, Exact Sciences of Piauí and Higher Education Institute of Vale do Parnaíba, PI; Brazil. Department of Medicine; Postgraduate in Biotechnology by the Higher Institute of Applied Theology - INTA; Master in Biomedical Sciences, Federal University of Piauí; PhD Student in Biotechnology

15

Corresponding author:

Mateus Nunes Carvalho

20 Conviver Parnaíba Residence , Q10C14
Parnaíba, PI, Brazil
Bairro João XXIII – CEP 64205-030

Tel: +55 (86) 99986-3966

25 Email: mateusnunes@gmail.com

30

LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR APPETITE SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS

ABSTRACT

5 Obesity is a disease characterized by excessive accumulation of body fat at a level that compromises the health of individuals and is associated with the development of chronic diseases. The current approach for the treatment of obesity is diet modification, institution of physical activity, pharmacotherapy followed or not by bariatric surgery. Although surgery has shown positive results in relation to weight loss and reversal of comorbidities, high cost, 10 invasiveness, mortality risk and restriction of the population able to perform the procedure, induces researches for less aggressive therapies. As an alternative, an endovascular minimally invasive procedure for the treatment of obesity is the embolization of branches of the left gastric artery, in order to promote the suppression of the hormone ghrelin. This peptide produced in the stomach fundus has been shown to be a potent stimulator of appetite and it 15 communicates the gastrointestinal system to the brain in the regulation of food intake and energy expenditure. The objective of this literature review is to analyze the preclinical, clinical and retrospective studies published to assess the safety, efficacy, side effects, ghrelin levels and the excess weight loss achieved after follow-up over a period. Scientific publications were searched in PubMed, Medline, CINHALL, Scopus, Cochrane and SCIELO 20 databases from February 1999 to February 2019 and 15 studies was included. It may be too early to compare the efficacy of this technique with bariatric surgery, as current reports describe only the experience with a limited number of patients with relatively short follow-up durations. In addition, the variability between these studies is high. Concerns were raised in early studies of delayed gastric emptying that may occur after this procedure. This would 25 need to be more formally evaluated. Once an acceptable safety profile is established, prospective, multicenter, randomized trials may be performed.

Key words: bariatric surgery, embolization, ghrelin, obesity, weight loss.

1 INTRODUCTION

Obesity is defined as body weight disproportionate to height with excessive
30 accumulation of adipose tissue, usually associated with systemic inflammation [1]. It is
associated with the development of chronic diseases such as type 2 diabetes (T2D),
hypertension, dyslipidemia, among others [2]. As a multifactorial etiology it involves
complex interactions between genes, hormones, environment and lifestyle. It's a chronic
disease with an upward prevalence. The number of obese people in the world has tripled
35 since 1975, totaling about 650 million people, affecting 13% of the adult population [3]. In
response to obesity and its complications, numerous strategies have been advocated in an
attempt to reduce its progression, for example lifestyle interventions, surgical, endoscopic
and pharmacological treatment.

The changes in lifestyle (CLS) attempt to act in the control of body mass, considering
40 consumption, energy expenditure and fat deposition [2]. Strategies, starting with diet and
practice of physical activity are used as first-line treatment to reverse obesity [4], however,
previous studies have shown that weight loss ranges from 5 to 10% in patients with body
mass index (BMI) between 25 and 34.9 kg / m². However, patients may return to their
original weight within 3 years after the start of the change [5].

45 Surgical options have been adopted as a more invasive and effective approach,
seeking to lose weight, improve comorbidities and quality of life. However, the benefits of
surgery are counterbalanced by early negative aspects, including postoperative infections,
nausea, vomiting, and late aspects, which may lead to malabsorption of vitamins and minerals
[6]. Endoscopic therapies such as the intragastric balloon and gastric pacing have also been
50 used, however, these techniques have several complications and drawbacks (Table 1).

Patients who are not successful in CLS and who are not candidates for bariatric surgery have other treatment options. There are six drugs approved by the U.S. Food and Drug Administration (FDA), which mostly act on the Central Nervous System (CNS) pathways reducing appetite, increasing satiety or decreasing fat absorption. However, the achieved weight loss is modest at a range of 2.0 to 6.5 kg and effectiveness is limited, because weight loss remains only while the drug is being administered [7] (Table 2).

During the last decades, much has been studied about the role of the stomach as an endocrine organ and its role in homeostatic control [8]. Although a large number of hormones that limit food intake (anorexigenic) has been recently discovered, the hormone ghrelin is the only hormone with an opposite effect (orexigenic) [9].

The plasma concentration of this peptide is high before meals and falls postprandially, suggesting a role of appetite and energy homeostasis [10]. The ghrelin-producing cells are located in the gastric fundus [11] and the vascular supply that irrigates this portion of the stomach comes predominantly from branches that arise from the left gastric artery [12]. When embolizing these branches, there is a reduction in blood supply to the region and, consequently, serum levels of ghrelin decrease, modifying the homeostatic balance of energy intake [13] (Figure1).

The objective of this literature review is to analyze the preclinical, clinical and retrospective studies published to assess the safety, efficacy, side effects, ghrelin levels and the mean weight loss achieved after follow-up over a period.

2 METODOLOGY

A literature review was conducted in which the scientific publications were searched in PubMed, Medline, CINHALL, Scopus, Cochrane and SCIELO databases from February 1999 to February 2019. The descriptors "gastric artery" and / or "weight loss" and / or

4

"obesity" and / or "bariatric surgery" and / or "embolization" and / or "ghrelin" were used. The references of the articles found underwent a manual review to verify the relevance and inclusion of studies.

Studies have included animal studies (preclinical), in humans (clinical) and
80 retrospective studies evaluating weight loss in patients submitted to embolization of the left gastric artery. A total of 148 records were identified by initial screening after searching the databases and reviewing references. Titles and abstracts were analyzed by all researchers individually. Of these works, only 15 remained to compose the research, which had all their text read to guarantee eligibility.

85

3 RESULTS

Left gastric artery embolization was first introduced in 1970 for the treatment of life-threatening gastric hemorrhage. Complications such as ischemic ulceration and infarction, both with good prognosis, due to the rich collateral circulation of the stomach[14].With the
90 emergence of new imaging techniques (micro, selective and 3D), vascular access devices (microcathodes, guidewires, snares) and emboli (coils, beads and microspheres), the spectrum of this approach was extended and it was applicated to the bariatric embolization of the left gastric artery aiming weight loss [15].

The safety and efficacy of this endovascular therapy for obesity has been verified by
95 several preclinical studies. Arepally et al. described for the first time the concept of chemical embolization of the left gastric artery in order to eradicate the ghrelin-producing cells in the stomach. A series of animal studies in pig models and obese dogs demonstrated a post-embolization reduction in serum levels of ghrelin and a decrease in weight gain in relation to the control group[16] (Table 3).

100 The first procedure performed in humans was presented at the 2013 annual meeting of
the American College of Cardiology, in which Kipshidze et al. presented a prospective study
involving left gastric artery embolization in 5 patients with the objective of evaluating the
safety and efficacy of the technique with the intention of reducing plasma levels of ghrelin
and achieving weight loss. Microspheres (Beadblock®) measuring between 300 and 500µm
105 in diameter.

All patients reported decreased appetite and BMI was reduced by 10%, 13%, 16%,
17%, and 17.2% after 1, 3, 6, 12, and 24 months of evaluation. Plasma levels of ghrelin were
significantly lower in the first and third months (-29% and -36%, respectively) and decreased
by up to 12 months (-21%). A slight transient epigastric discomfort was described in three of
110 the five patients[17].

This study preceded a case report published by Salsamendi et al. in 2015, in which a
patient with 81kg and 42kg / m² BMI of 68 years diagnosed with hepatocellular carcinoma
and who needed a liver transplant due to morbid obesity was not a candidate for the
transplant list. For 7 months the patient tried to reduce weight without success.

115 Responsible physicians chose to perform embolization of the left gastric artery in an
attempt to reduce weight. Microspheres (Beadblock®) measuring between 500 and 700 µm in
diameter were used. Seven months after the procedure, the patient was 71.5kg and BMI 36kg
/ m² with no lifestyle modifications and could be placed in the transplant queue [18].

After these initial studies, clinical trials have been performed. In 2016, Syed et al.
120 published the Gastric Artery Embolization Trial for the Lessening Appetite Nonsurgically
(GET LEAN), in which four patients with a mean BMI of 42.4 kg / m² underwent AGE
embolization using microspheres (Beadblock®) measuring between 300 and 500 µm. After 6
months, mean BMI fell by 8.5%. At endoscopy performed for follow-up, 75% of the patients
presented superficial gastric ulceration [19].

125 As early as 2017, Weiss et al. published the "Bariatric arterial embolization trial"
(BEAT Obesity) in which five patients with a BMI greater than 40 kg / m² were submitted to
embolization of the stomach gastric fundus. Embosphere® microspheres of 300 to 500 µm in
diameter were used, with consequent decrease of ghrelin by 17.5% and reduction of excess
weight by 9% after 3 months. Patients reported decreased appetite from the second week
130 [20].

 Still in the same year, Bai et al. evaluated the safety of the procedure and the side
effects in 5 obese patients with a mean BMI of 38.1kg / m². Four patients reported decreased
appetite and mild transient epigastric discomfort resolved within 48 hours. One patient
developed an ulcer, diagnosed 3 days after the procedure by endoscopy, which spontaneously
135 cured in 30 days with PPI. After 9 months, the mean weight loss was 12.64% [21].

 The most recent prospective study was published in 2018 in which Pirlet et al. aimed
at evaluating the feasibility, efficacy and safety of the procedure. Seven morbidly obese
patients (mean BMI of 52 kg / m²) who were to undergo coronary angiography were selected.
Taking advantage of the radial access, selective catheterization of the left gastric artery
140 (confirmed by angiography) and polyvinyl alcohol (PVA) particles 300 to 500 µm in
diameter were injected. A mean reduction of 13 kg was observed after 12 months of the
procedure, corresponding to a decrease of 8.13% in the mean BMI [22].

 In addition to prospective studies, retrospective research has also been published.
Gunn and Oklu, in 2014, performed an analysis of medical records of patients undergoing
145 embolization of the left gastric artery to contain hemorrhages of the upper gastrointestinal
tract. Post-procedure weight loss in this group was compared with a control group of patients
who had embolization of other arteries for upper gastrointestinal bleeding (HDA). Half of the
control group had a history of malignancy and 6 of these patients were receiving
chemotherapy during the study period [23].

150 Anton et al. Carried out a retrospective review of patients submitted to arterial embolization for acute upper gastrointestinal bleeding between January 2002 and January 2014. Patients with documented history of malignancy prior to embolization or during the follow-up period were excluded to remove bias from potential weight loss of active malignancy. After excluding patients who did not meet the inclusion criteria, the sample size
155 was small, which limited the power of the study and the statistical significance [24].

In 2018, a retrospective study of a single institution was conducted by Kim et al. in which patients who underwent left gastric artery embolization for treatment of acute gastrointestinal bleeding from 2001 to 2016 were identified through a hospital medical records survey. Those selected were between 33 and 92 years of age and should not have
160 cancer diagnoses at the time of the procedure. The median pre-procedure weight and BMI of the patients evaluated in this study were 93.4 kg and 29.9 kg / m², respectively. A median of 16.3 kg of weight loss (p = 0.045) was observed after 12 months [25].

Finally, a Belgian study was published in November 2018 to evaluate the efficacy and safety of left gastric artery embolization (LGAE) for the treatment of 17 overweight patients
165 who were not candidates for bariatric surgery (mean BMI of 28.9kg / m²). Only one patient had gastric ulceration in endoscopy after post-procedure. One patient was terminated in the intensive care unit due to pancreatitis and gastric perforation. The mean weight loss was 8 kg, reducing the mean BMI to 25.5 [26].

170 **DISCUSSION**

Obesity is a disease characterized by excessive accumulation of body fat at a level that compromises the health of individuals [27], being associated with comorbidities such as T2D, hypercholesterolemia, hypertension, heart attack, stroke, obstructive apnea sleep, asthma,

osteoarthritis, phlebitis, gout, polycystic ovary syndrome, infertility, depression and cancer
175 [2].

The diagnosis of obesity is based on the BMI, a parameter stipulated by the World Health Organization, obtained from the relationship between body weight (kg) and height (m) of the individuals. Through this parameter, individuals whose BMI is equal to or greater than 30 kg / m² are considered obese [27].

180 The overall growth of body mass index (BMI) has increased morbidity and mortality associated with obesity, which has led to a public health epidemic [28]. The main therapeutic approaches for obesity include changes in lifestyle, surgical intervention and pharmacotherapy.

Lifestyle changes, including diet and physical activity, may be beneficial for
185 overweight patients (BMI between 25 and 29.9) and patients with mild obesity (BMI between 30 and 34.9). On average, a weight loss of 5 to 10% [29], however, those who only practice lifestyle modification have not shown sustained weight loss [30,31].

More aggressive measures, such as bariatric surgery (Roux-en-Y gastric bypass, adjustable gastric banding and vertical gastrectomy), are reserved for morbidly obese
190 (defined as BMI greater than or equal to 40) or obese with a BMI above 35 and obesity-related comorbidity [32].

Postoperative complications, such as anastomosis leakage, intussusception and gallstones, have decreased with the advent of laparoscopic techniques; however, when they occur, they can be severely debilitating for the patient, resulting in increased morbidity and
195 mortality [33,34].

The most successful approach to obese weight loss has been bariatric surgery [35,36], however, due to the invasiveness, cost and possible morbidity associated with this procedure, research is encouraged on new alternatives that are less invasive [37].

Some examples include endoscopic therapies such as intragastric balloon, endoscopic
200 gastric plication, endoscopic mango gastropasty, as well as gastric electrical stimulators [38].
These methods have been shown to be more effective than lifestyle changes, with a lower risk
of complications than bariatric surgery, and are being evaluated to determine long-term safety
[39].

There are also drugs approved for treatment of obesity. Pharmacotherapy is currently
205 an adjunct therapy, not one of the pillars of obesity management. Pharmacological
modulation of hunger could provide a solution to this epidemic; however, currently available
drug candidates show a modest variation in weight loss (Table 2). Long-term adherence to
drug therapy remains a constant challenge due to the high cost and considerable adverse
effects associated with such therapy [40,41].

210 The embolization of branches of the left gastric artery is an alternative for the
treatment of obesity, since it is a minimally invasive procedure based on the hormonal effects
of bariatric surgery[42].

The rationale for bariatric embolization as a target in the treatment of obesity arises
from the role of ghrelin, a peptide of 28 amino acids[43], secreted mainly from the stomach
215 fundus(90%)⁸.It acts on the appetite stimulus and induces hunger, increasing food intake and
results in weight gain[44].

Plasma ghrelin levels increase significantly before meals (inducing hunger) and
decrease after feeding (as part of the satiety response), which characterizes it as an orexigen
hormone [45,46].

220 However, ghrelin levels do not decrease when the obese patient feeds, which may
contribute to overeating [47]. In addition, this peptide may be partially responsible for weight
loss after bariatric surgery [48].

By creating ischemia mainly on the gastric fundus, bariatric embolization aims to target ghrelin-producing cells in order to reduce their plasma levels and thus reduce hunger
225 by contributing to weight loss in obese patients [49].

This procedure could be considered a bridge to other procedures, as suggested in a recently published case report describing left gastric artery embolization in an obese patient with hepatocellular carcinoma awaiting surgery[18]. The question of whether this procedure can be used as a bridge to other bariatric procedures is far from being resolved.

230 It may be too early to compare the efficacy of this technique with bariatric surgery, as current reports describe only the experience with a limited number of patients with relatively short follow-up durations. In addition, the variability between these studies is high (Table 4). In comparison, bariatric surgery has a wealth of data confirming sustained loss (≥ 6 years) between 22% and 55% of pre-intervention body weight, depending on the type of bariatric
235 surgery performed [50]. Similarly, regarding complications, the safety profile of bariatric embolization cannot be inferred from the limited experience available with this technique.

5 CONCLUSION

The use of the interventional technique of embolization of the left gastric artery is
240 already widely used for the treatment of gastrointestinal bleeding. However, this procedure in an elective scenario as treatment of obesity still lacks research to prove long-term efficacy and safety. Several obstacles remain in the way of starting this therapy for main use in weight loss.

There is still no consensus as to which embolization materials would be ideal if small
245 particles or liquid sclerosing agents would provide the best profile to achieve long-lasting vascular occlusion and penetrate smaller capillaries, avoiding non-target embolization and associated tissue injury.

In addition, concerns were raised in early studies of delayed gastric emptying that may occur after this procedure. This would need to be more formally evaluated. Once an acceptable safety profile is established, prospective, multicenter, randomized trials may be performed.

255

REFERENCES

- [1] Williams EP, Mesidor M, Winters K, Dubbert PM, Wyatt SB. Overweight and Obesity: Prevalence, Consequences, and Causes of a Growing Public Health Problem. *Current Obesity Reports*, 2015; 4(3):363-370.
- 260 [2] González-Muniesa P, Martínez-González MA, Hu FB, et al. Obesity. *Nature Reviews Disease Primers*, 2017; 3: 1-18.
- [3] World Health Organization. Obesity and overweight, Fact sheet number 311. WHO; 2015. [accessed 03/24/2018]. Available from <http://www.who.int/mediacentre/factsheets/fs311/en/>
- 265 [4] Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and Trends in Obesity Among US Adults, 1999-2008. *Jama*, 2010; 303(3):235-241.
- [5] Christian JG, Tsai AG, Bessesen DH. Interpreting weight losses from lifestyle modification trials: using categorical data. *International Journal Of Obesity*, 2009; 34:207-209.
- 270 [6] Stefater MA, Kohli R, Inge TH. Advances in the surgical treatment of morbid obesity. *Molecular Aspects Of Medicine*, 2013; 34(1):84-94.
- [7] Glandt M, Raz I. Present and Future: Pharmacologic Treatment of Obesity. *Journal Of Obesity*, 2011; 2011:1-13.
- [8] Wren AM, Bloom SR. Gut Hormones and Appetite Control. *Gastroenterology*, 2007; 132(6): 2116-2130.
- 275 [9] Vairavamurthy J, Cheskin LJ, Kraitchman DL, Arepally A, Weiss CR. Current and cutting-edge interventions for the treatment of obese patients. *European Journal Of Radiology*, 2017; 93:134-142.

- 280 [10] Cummings DE. Ghrelin and the short- and long-term regulation of appetite and body weight. *Physiology & Behavior*, 2006; 89(1): 71-84.
- [11] Takiguchi S, Adachi S, Yamamoto K, et al. Mapping Analysis of Ghrelin Producing Cells in the Human Stomach Associated with Chronic Gastritis and Early Cancers. *Digestive Diseases And Sciences*, 2011; 57(5): 1238-1246.
- 285 [12] Gregorczyk M, Agnieszka, J. Arterial supply of gastric fundus in human: Final results. *Medtube Science*, 2015; 2(3): 30-34.
- [13] Madoff, DC. Science to Practice: Can Transarterial Embolotherapy Be Used as a Viable Alternative to Treat Obesity?. *Radiology*, 2013; 266(2): 369-371.
- [14] Prochaska JM, Flye MW, Johnsrude IS. Left Gastric Artery Embolization for Control of Gastric Bleeding: A Complication. *Radiology*, 1973; 107(3): 521-522.
- 290 [15] Vaidya S, Tozer KR, Chen J. An Overview of Embolic Agents. *Seminars In Interventional Radiology*, 2008; 25(3): 204-215.
- [16] Arepally A, Barnett BP, Patel TH, et al. Catheter-directed Gastric Artery Chemical Embolization Suppresses Systemic Ghrelin Levels in Porcine Model. *Radiology*, 2008; 249(1):127-133.
- 295 [17] Kipshidze N, Archvadze A, Bertog S, et al. Endovascular Bariatrics: First in Humans Study of Gastric Artery Embolization for Weight Loss. *JACC: Cardiovascular Interventions*, 2015; 8(12):1641-1644.
- [18] Salsamendi J, Pereira K, Kang K, Fan J. Minimally invasive percutaneous endovascular therapies in the management of complications of non-alcoholic fatty liver disease (NAFLD): A case report. *Journal Of Radiology Case Reports*, 2015; 9(9):36-43.
- 300 [19] Syed MI, Morar K, Shaikh A, et al. Gastric Artery Embolization Trial for the Lessening of Appetite Nonsurgically (GET LEAN): Six-Month Preliminary Data. *Journal Of Vascular And Interventional Radiology*, 2016; 27(10): 1502-1508.
- [20] Weiss CR, Akinwande O, Paudel K, et al. Clinical Safety of Bariatric Arterial Embolization: Preliminary Results of the BEAT Obesity Trial. *Radiology*, 2017; 283(2): 598-608.
- [21] Bai ZB, Qin YL, Deng G, Zhao GF, Zhong BY, Teng GJ. Bariatric Embolization of the Left Gastric Arteries for the Treatment of Obesity: 9-Month Data in 5 Patients. *Obesity Surgery*, 2018; 28(4):907-915.
- 310 [22] Pirlet C, Ruzsa Z, Costerousse O, et al. Transradial left gastric artery embolization to treat severe obesity: A pilot study. *Catheterization And Cardiovascular Interventions*, 2018; 93(3):365-370.
- [23] Gunn AJ, Oklu R. A Preliminary Observation of Weight Loss Following Left Gastric Artery Embolization in Humans. *Journal Of Obesity*, 2014; 2014:1-4.

- 315 [24] Anton K, Rahman T, Bhanushali AB, Nadal LL, Pierce G, Patel AA. Weight Loss Following Left Gastric Artery Embolization in a Human Population without Malignancy: A Retrospective Review. *Journal Of Obesity & Weight Loss Therapy*, 2015; 5(6):1-4.
- [25] Kim JM, Kim MD, Han K, et al. Bariatric Arterial Embolization with Non-spherical Polyvinyl Alcohol Particles for Ghrelin Suppression in a Swine Model. *Cardiovascular And*
320 *Interventional Radiology*, 2017; 40(5):744-749.
- [26] Elens S, Roger T, Elens M, et al. Gastric Embolization as Treatment for Overweight Patients; Efficacy and Safety. *Cardiovascular And Interventional Radiology*, 2018; 42(4):513-519.
- [27] World Health Organization. Obesity: preventing and managing the global epidemic: report of a WHO consultation. World Health Organization; Geneva: 2000. p. 253.
325
- [28] Finucane MM, Stevens GA, Cowan MJ, et al. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9·1 million participants. *The Lancet*, 2011; 377(9765):557-567.
- 330 [29] Jones LR, Wilson CI, Wadden TA. Lifestyle Modification in the Treatment of Obesity: An Educational Challenge and Opportunity. *Clinical Pharmacology & Therapeutics*, 2007; 81(5):776-779.
- [30] Aronne LJ, Wadden T, Isoldi KK, Woodworth KA. When Prevention Fails: Obesity Treatment Strategies. *The American Journal Of Medicine*, 2009; 122(4):24-32.
- 335 [31] Cawley J, Meyerhoefer C. The medical care costs of obesity: An instrumental variables approach. *Journal Of Health Economics*, 2012; 31(1):219-230.
- [32] Campos J, Ramos A, Szego T, Zilberstein B, Feitosa H, Cohen R. The role of metabolic surgery for patients with obesity grade and type 2 diabetes not controlled clinically. *Abcd. Arquivos Brasileiros de Cirurgia Digestiva*, 2016; 29(1):102-106.
- 340 [33] Reoch J, Mottillo S, Shimony A, Filion KB. Safety of Laparoscopic vs Open Bariatric Surgery. *Archives Of Surgery*, 2011; 146(11):1314-1322.
- [34] Baptista V, Wassef W. Bariatric procedures: an update on techniques, outcomes and complications. *Current Opinion In Gastroenterology*, 2013; 29(6):684-693.
- 345 [35] Vix M, Diana M, Liu KH, et al. Evolution of Glycolipid Profile After Sleeve Gastrectomy vs. Roux-en-Y Gastric Bypass: Results of a Prospective Randomized Clinical Trial. *Obesity Surgery*, 2012; 23,(5):613-621.
- [36] Vix M, Liu KH, Diana M, D'Urso A, Mutter D, Marescaux J. Impact of Roux-en-Y gastric bypass versus sleeve gastrectomy on vitamin D metabolism: short-term results from a prospective randomized clinical trial. *Surgical Endoscopy*, 2013; 28(3):821-826.
- 350 [37] Bennett JM, Mehta S, Rhodes M. Surgery for morbid obesity. *Postgraduate Medical Journal*, 2007; 83(975):8-15.

- [38] Kumar N, Thompson CC. Endoscopic solutions for weight loss. *Current Opinion In Gastroenterology*, 2011; 27(5):407-411.
- 355 [39] Verdam FJ, Schouten R, Greve JW, Koek GH, Bouvy ND. An Update on Less Invasive and Endoscopic Techniques Mimicking the Effect of Bariatric Surgery. *Journal Of Obesity*, 2012; 2012:1-10.
- [40] Maahs D, de Serna DG, Kolotkin RL, et al. Randomized, double-blind, placebo-controlled trial of orlistat for weight loss in adolescents. *Endocrine Practice*, 2006; 12(1):18-28.
- 360 [41] Coutinho AK, Glancey GR. Orlistat, an under-recognised cause of progressive renal impairment. *Nephrology Dialysis Transplantation*, 2013; 28(4):172-174.
- [42] Weiss CR, Gunn AJ, Kim CY, Paxton BE, Kraitchman DL, Arepally A. Bariatric Embolization of the Gastric Arteries for the Treatment of Obesity. *Journal Of Vascular And Interventional Radiology*, 2015; 26(5):613-624.
- 365 [43] Kojima M, Hosoda H, Date Y, Nakazato M, Matsuo H, Kangawa K. Ghrelin is a growth-hormone-releasing acylated peptide from stomach. *Nature*, 1999; 402(6762):656-660.
- [44] Cummings DE, Overduin J. Gastrointestinal regulation of food intake. *Journal Of Clinical Investigation*, 2007; 117(1):13-23.
- 370 [45] Wren AM, Seal LJ, Cohen MA, et al. Ghrelin Enhances Appetite and Increases Food Intake in Humans. *The Journal Of Clinical Endocrinology & Metabolism*, 2001; 86(12):5992-5992.
- [46] Cummings DE, Purnell JQ, Frayo RS, Schmidova K, Wisse BE, Weigle DS. A Preprandial Rise in Plasma Ghrelin Levels Suggests a Role in Meal Initiation in Humans. *Diabetes*, 2001; 50(8):1714-1719.
- 375 [47] English PJ, Ghatti MA, Malik IA, Bloom SR, Wilding JP. Food Fails to Suppress Ghrelin Levels in Obese Humans. *The Journal Of Clinical Endocrinology & Metabolism*, 2002; 87(6):2984-2984.
- [48] Cummings DE, Weigle DS, Frayo RS, et al. Plasma Ghrelin Levels after Diet-Induced Weight Loss or Gastric Bypass Surgery. *New England Journal Of Medicine*, 2002; 346(21):1623-1630.
- 380 [49] Weiss CR, Kathait AS. Bariatric embolization: a new and effective option for the obese patient?. *Expert Review Of Gastroenterology & Hepatology*, 2017; 11(4):293-302.
- [50] Piché MÈ, Auclair A, Harvey J, Marceau S, Poirier P. How to Choose and Use Bariatric Surgery in 2015. *Canadian Journal Of Cardiology*, 2015; 31(2):153-166.
- 385 [51] Allison DB, Gadde KM, Garvey WT, et al. Controlled-Release Phentermine/Topiramate in Severely Obese Adults: A Randomized Controlled Trial (EQUIP). *Obesity*, 2011; 20(2):330-342.
- [52] Alvarez, R; Telem, DA. Comparative Surgical Outcomes in Bariatric Surgery. *The Sages Manual Of Bariatric Surgery*, 2018; 339-361.

- 390 [53] Antel J, Hebebrand J. Weight-Reducing Side Effects of the Antiepileptic Agents Topiramate and Zonisamide. *Handbook Of Experimental Pharmacology*, 2012;209:433-466.
- [54] Apovian CM. Naltrexone/bupropion for the treatment of obesity and obesity with Type 2 diabetes. *Future Cardiology*, 2016; 12(2):129-138.
- 395 [55] Arepally A, Barnett BP, Montgomery E, Patel TH. Catheter-directed Gastric Artery Chemical Embolization for Modulation of Systemic Ghrelin Levels in a Porcine Model: Initial Experience. *Radiology*, 2007; 244(1):138-143.
- [56] Aronne LJ, Wadden TA, Peterson C, Winslow D, Odeh S, Gadde KM. Evaluation of phentermine and topiramate versus phentermine/topiramate extended-release in obese adults. *Obesity*, 2013; 21(11):2163-2171.
- 400 [57] Bawudun D, Xing Y, Liu WY, et al. Ghrelin Suppression and Fat Loss after Left Gastric Artery Embolization in Canine Model. *Cardiovascular And Interventional Radiology*, 2012; 35(6):1460-1466
- [58] Buchwald H, Avidor Y, Braunwald E, Jensen MD, et al. Bariatric Surgery: a systematic review and meta-analysis. *JAMA*, 2004; 292(14):1724-1737.
- 405 [59] Fu Y, Weiss CR, Paudel K, Shin EJ, et al. Bariatric Arterial Embolization: Effect of Microsphere Size on the Suppression of Fundal Ghrelin Expression and Weight Change in a Swine Model. *Radiology*, 2018; 289(1):83-89.
- [60] Gadde KM, Allison DB, Ryan DH, et al. Effects of low-dose, controlled-release, phentermine plus topiramate combination on weight and associated comorbidities in overweight and obese adults (CONQUER): a randomised, placebo-controlled, phase 3 trial. *The Lancet*, 2011; 377(9774):1341-1352.
- 410 [61] Garvey WT, Ryan DH, Look M, et al. Two-year sustained weight loss and metabolic benefits with controlled-release phentermine/topiramate in obese and overweight adults (SEQUEL): a randomized, placebo-controlled, phase 3 extension study. *The American Journal Of Clinical Nutrition*, 2011; 95(2):297-308.
- 415 [62] Hendricks EJ1, Srisurapanont M2, Schmidt SL3, Haggard M. Addiction potential of phentermine prescribed during long-term treatment of obesity. *International Journal Of Obesity*, 2013; 38(2):292-298.
- [63] Hvizdos, KM, Markham, A. Orlistat: a review of its use in the management of obesity. *Drugs*, 1999; 58(4):743-760.
- 420 [64] Kim DJ, Raman HS, Salter A, et al. Analysis of weight changes after left gastric artery embolization in a cancer-naïve population. *Diagnostic And Interventional Radiology*, 2018; 94-9.
- [65] O'Neil PM, Smith SR, Weissman NJ, et al. Randomized Placebo-Controlled Clinical Trial of Lorcaserin for Weight Loss in Type 2 Diabetes Mellitus: The BLOOM-DM Study. *Obesity*, 2012; 20(7):1426-1436.
- 425 [66] Paxton BE, Kim CY, Alley CL, et al. Bariatric Embolization for Suppression of the Hunger Hormone Ghrelin in a Porcine Model. *Radiology*, 2013; 266(2):471-479.

- 430 [67] Pi-Sunyer X, Astrup A, Fujioka K, et al. A Randomized, Controlled Trial of 3.0 mg of Liraglutide in Weight Management. *New England Journal Of Medicine*, 2015; 373(1):11-22.
- [68] Torgerson JS, Hauptman J, Boldrin MN, Sjöström L. XENical in the Prevention of Diabetes in Obese Subjects (XENDOS) Study: A randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients. *Diabetes Care*, 2003; 27(1):155-161.
- 435 [69] Weir MA, Beyea MM, Gomes T, et al. Orlistat and Acute Kidney Injury: An Analysis of 953 Patients. *Archives Of Internal Medicine*, 2011; 171(7):703-704.
- [70] Yanovski SZ, Yanovski JA. Long-term Drug Treatment for Obesity. *JAMA*, 2014; 311(1):74-86.
- 440 [71] Zhong BY, Abiola G, Weiss CR. Bariatric Arterial Embolization for Obesity: A Review of Early Clinical Evidence. *Cardiovascular And Interventional Radiology*, 2018; 41(11):1639-1647.
- [72] Srivastava G, Apovian CM. Current pharmacotherapy for obesity. *Nat Rev Endocrinol*. 2018;14:12-24

Table 1 Table 1 – Bariatric Procedures [52,58]

Procedures	Type	Advantages	Disadvantages	Complications	(%EWL)
Adjustable gastric banding	Surgery	Reduces the stomach inlet and achieves a great weight loss	Patients require close follow-up and adjustments of the band's inner diameter based on patient's weights and symptoms. Have a reoperation rate of 5% per year	Band slippage, cephalad gastric prolapse through the band, band erosion, esophageal dilatation, and malfunction of the reservoir or tubing	Achieves an average 44% EWL.
Sleeve gastrectomy	Surgery	Is associated with minimal morbidity, avoids the use of foreign material like gastric band, and has fewer long-term problems	The procedure can cause staple line leaks and strictures	Leaks may not heal spontaneously since the remaining gastric tube operates at high pressure	At 5 years, the EWL is between 33% and 85%
Biliopancreatic diversion	Surgery	Most patients maintain the lost weight off over 21 years, there is 98% remission of diabetes 10 years after the surgery, and both hypertension and dyslipidemia improve	Nutritional deficit due to the anastomose linking the stomach directly to the final segment of the ileum. Weight loss occurs since most of the calories and nutrients are routed into the colon where they are not absorbed	Causes long-term diarrhea, anemia, protein malnutrition (in 30% of patients), dumping syndrome, peripheral neuropathy, and osteoporosis (calcium malabsorption)	In a historical review of 2241 patients, EWL after 1 year averages 75%
Roux-en-Y gastric bypass	Surgery	Rapid improvement in glucose regulation and achieves a great weight loss	Nutritional deficiencies after gastric bypass occur in 30% of patients. Malabsorption of the fat-soluble vitamins A, D, E, and K, and vitamin B12, are quite common. Iron deficiency, anemia and calcium malabsorption often occur after gastric bypass procedures	Infection, venous thromboembolic disease, hemorrhage, development of the ventral or intraabdominal hernias, and bowel obstruction. Additionally, anastomotic leaks, strictures, and ulcers may develop	Achieves an average 50% EWL
Intragastric Balloon	Endoscopic	Preserve the anatomy of the stomach. Intragastric balloons are temporary, and the stimulus that resulted in weight loss is removable.	Between 6 and 15% of patients will not tolerate the balloon, and the requiring early removal due to persistent nausea, vomiting and abdominal pain or cramps.	Balloon can migrate causing small bowel obstruction, perforation (mostly limited to patients who previously underwent surgeries to their stomach), and worsening of acid reflux	At 6 months, achieves an average of 33.9% EWL
Gastric estimation	Endoscopic	Low surgical risk and has the advantage of allowing for adjustments to the pacer device on demand	All use stimuli that are essentially not perceived by subjects, which may limit their long-term efficacy	Implant site pain, infection, stomach wall perforation, lead penetration, lead obstruction of intestines, lead / device problems, irritation / inflammation, uncomfortable / unwanted stimulation, and tissue damage, among others.	At >12 months, on average, there was a loss of 20% of EWL in these patients

Note - EWL = Estimated Excess Weight Loss

Table 2

Table 2 – Currently available anti-obesity pharmacological treatment			
Drug	Mechanism of action	Common adverse effects	Weight loss
Phentermine	Sympathomimetic amine that is believed to suppress appetite and release insignificant quantities of dopamine compared with amphetamines [62]	Increase in heart rate and/or blood pressure, dizziness, dry mouth, constipation, insomnia and irritability [70]	A 2013 clinical trial, reported a weight loss of 5.1% at 28 weeks [56]
Orlistat	Inhibits the activity of pancreatic and gastric lipases, thereby decreasing fat absorption by 30% [63]	Flatulence, oily spotting, fecal urgency, and fatty/oily stool, oily defecation, increased defecation and fecal incontinence, nephrotoxicity, hepatotoxicity, nephrolithiasis and pancreatitis [69]	A 2004 prospective study in which 3,305 patients with obesity were randomly assigned to lifestyle changes plus either 120 mg orlistat or placebo three times daily, mean weight loss was statistically significant with orlistat (5.8 kg versus 3.0 kg with placebo; $P<0.001$) [68]
Phentermine/topiramate ER	Sympathomimetic, raises concentration of norepinephrine being anorexigenic [53]	Blurred vision, paresthesia, headache, irritability, dizziness, insomnia, depression and anxiety [51,60]	A 2012 clinical trial reported a 9.3% body weight loss in the 7.5/46 mg group and a 10.5% body weight loss in the 15/92 mg group compared with the placebo group (-1.8%; $P<0.0001$) [61]
Lorcaserin	A 5HT _{2C} agonist that acts on anorexigenic POMC neurons in the hypothalamus [72]	Nausea, dry mouth, headache, dizziness, fatigue and constipation [72]	A 2012 randomized placebo-controlled clinical trial reported 5.0% body weight loss compared with the placebo group (-1.5%; $P<0.001$) [65]
Naltrexone SR/bupropion SR	Naltrexone blocks opioid receptor mediated POMC autoinhibition, and bupropion selectively inhibits reuptake of dopamine and noradrenaline and aminoketone antidepressant [54]	Nausea, constipation, headaches, vomiting, dizziness and dry mouth	[75] A 2013 randomized clinical trial reported a 6.4% body weight loss in the 32/360 mg group compared with the placebo group (-1.2%; $P<0.001$) [54]
Liraglutide	A GLP1 receptor agonist of an incretin derived hormone that acts through both peripheral and central receptor pathways affecting glucose homeostasis, food intake and satiety. [72]	Nausea, diarrhea, constipation, vomiting, dyspepsia and abdominal pain [67]	In a 2015 Randomized Controlled Trial, a total of 63.2% of the patients in the liraglutide group as compared with 27.1% in the placebo group lost at least 5% of their body weight ($P<0.001$), and 33.1% and 10.6%, respectively, lost more than 10% of their body weight ($P<0.001$). [67]

Note – GLP1 = glucagon-like peptide 1; 5HT_{2C} = 5hydroxytryptamine receptor 2C; POMC = Pro-opiomelanocortin

Table 3 Table 3 – Preclinical studies of left gastric artery gastric embolization aimed at reducing ghrelin and weight loss

AUTHOR	YEAR	STUDY	GROUPS	CHANGE IN GHRELIN LEVELS	CHANGE IN WEIGHT	EXTRA
Areppally et al. [55]	2007	Prospective study, suine model	Total of 8 pigs: 2 pigs in the control group, 4 in low dose embolization and 2 in high dose embolization.	Control group: no significant change; low dose group: increase of 245% $\pm$ 34%; high dose group: increase of 104% $\pm$ 23.4%	Mean value ($\pm$ SD) at 4 weeks: control group, increase of 8.6% $\pm$ 0.9%; low dose and high dose embolization: increase of 1.4% $\pm$ 10.9%; without statistically significant difference	Dose escalation trial (for each administered dose, n = 1), produced widely varying results
Areppally et al. [16]	2008	Prospective study, suine model	Total of 10 pigs: 5 in the control group and 5 in the embolization group	Control group: 2.6% increase in 3 weeks and 18.2% increase in 4 weeks; Embolization Group, 42.5% reduction in 3 weeks and 12.9% reduction in 4 weeks	Mean value ($\pm$ SD) at 4 weeks: control group, increase of 15.1% $\pm$ 6%; Embolization, increase of 7.8% $\pm$ 5.5%	Dose escalation test (for each administered dose, n = 1), large dose group
Bavudun et al. [57]	2012	Prospective study, canine model	Total of 15 canines: 5 in the control group, 5 in the group receiving bleomycin and embolization with elicited oil, reduction of 15.8%; group receiving particles of PVA plus embolization, reduction of 30.2%	Control group, increase of 13.6%; group receiving bleomycin and embolization with elicited oil, reduction of 15.8%; group receiving particles of PVA plus embolization, reduction of 30.2%	For the control group, percentage increase in baseline weight; for both embolization groups, percentage reduction of basal weight (the percentage reduction of peak occurred in week 2 or 3)	Subcutaneous fat amount also decreased in the embolization vs control groups
Paxton et al. [66]	2013	Prospective study, suine model	Total of 12 pigs: 6 in the control group and 6 in the embolization group	Mean value ($\pm$ SD): for the control group, increase of 328.9 $\pm$ 129 pg / dL; for the Embolization group, a decrease of 537.9 $\pm$ 209.6 pg / dL	Mean value ($\pm$ SD) over 8 weeks of follow-up: for the control group, increase of 9.4 $\pm$ 2.8 kg; for the embolization group, increase of 3.6 $\pm$ 3.8 kg	Control animals were submitted to a simulated procedure with 5 mL of saline solution; The Embolization was performed with 4-6 mL of 40 μ m calibrated microspheres diluted in saline solution
Kim et al. [25]	2017	Prospective study, suine model	Total of 10 pigs: 5 in the control group and 5 in the Embolization group	Control group: no significant change. Mean ($\pm$ SD) for the Embolization group decreased 53.6 $\pm$ 33.43 pg / dL at 3 weeks and 51.5 $\pm$ 15.0 pg / dL at 5 weeks	Mean value ($\pm$ SD): for the control group, increase of 11.5 $\pm$ 6.2 kg; for the embolization group, increase of 9.4 $\pm$ 0.8 kg	The Embolization was performed with non - spherical particles PVA 50-150 or 150-250 μ m diluted with 60 ml of a 50% saline solution and contrast agent.
Fu et al. [59]	2018	Prospective study, suine model	Total of 19 pigs: 9 in the control group and 10 in the embolization group	Particles range 100-300 μ m diameter results in a greater reduction in ghrelin expressing cells of than the 300-500 μ m	In pigs treated with smaller microspheres, the mean weight gain at 16 weeks was lower than in control pigs	All pigs embolized with the smaller microspheres and 60% of the embolized ones with larger microspheres had ulcers.

Note: PVA= Polyvinyl acetate; SD = standard deviation

Table 4

Table 4 – Prospective and retrospective left gastric artery embolization studies in humans

AUTHOR	YEAR	M A L E	F E M	STUDY	EMBOLIC AGENT	EMBOLIC AGENT SIZE	FOLLO W UP	PRIMARY OBJECTIVE	RESULTS	ADVERSE EVENTS	MEAN BMI
Gunn [23]	2014	19	12	7	Retrospective	Coils, gelfoam, pva 300–500 500–710 710–1000	14 months	Weight Loss	Reduction of BMI by 7.3% in the first 45 days and reduction of 3.5% in 13 months.	Unknown	30,3
Anton [24]	2015	10	7	3	Retrospective	Coils, gelfoam N/a	12 months	Weight Loss	Reduction of BMI by 10%, 11.29%, 9.03%, and 6.45% after 1, 4, 8 and 12 months;	Unknown	31
Kipshidze [17]	2015	5	4	1	Prospective	Bead block® 300-500	24 months	Safety and Efficacy	Reduction of BMI by 10%, 13%, 16%, 17%, and 17.2% after 1, 3, 6, 12, and 24 months; reduction in plasma levels of ghrelin	Mild transient epigastric discomfort	42,2
Salsamendi [18]	2015	1	0	1	Prospective	Embosphere® Microspheres 500-700	7 months	Weight Loss	Reduction of BMI by 14.3% and reduction of hepatic steatosis	No complications reported	42
Syed [19]	2016	4	1	3	Prospective	Bead block® 300-500	6 months	Safety fo the procedure	Reduction of BMI by 8.5%, improvement in glycated hemoglobin from 7.4% to 6.3% in 6 months	Nausea with occasional vomiting, slight transient epigastric discomfort	42,4
Bai [21]	2017	5	3	2	Prospective	Pva 500-710	9 months	Safety fo the procedure	Reduction of BMI by 7.58%, 9.79%, and 12.64% after 3, 6, and 9 months;	Surface ulceration with hematoma at the puncture site	38,1
Weiss [20]	2017	5	1	4	Prospective	Embosphere® Microspheres 300-500	3 months	Safety fo the procedure	Mean change in serum ghrelin was 8.7% $\pm$ 34.7 and -17.5% $\pm$ 29 at 1 month and 3 months, respectively	Transient pancreatitis, asymptomatic superficial ulceration	43,8
Ellens [26]	2018	16	2	14	Retrospective	Embosphere® Microspheres 300-500 500-700	12 months	Safety and Efficacy	Reduction of BMI by 10% after 6 months	6% had a superficial gastric ulceration observed on endoscopy after the intervention	28,9
Kim [25]	2018	12	9	0	Retrospective	Coils, gelfoam, pva 300-500 500-700	12 months	Weight Loss	Reduction of BMI by 9.36% in an average time of 12 months	superficial ulceration	29,9
Pirlet [22]	2018	7	7	0	Prospective	Pva 300-500 100-300	12 months	Weight Loss	Reduction of BMI by 4.38%, 3.75%, 8.18% in 2, 6 and 12 months respectively	mild transient abdominal pain	52

Note: BMI = Body mass index

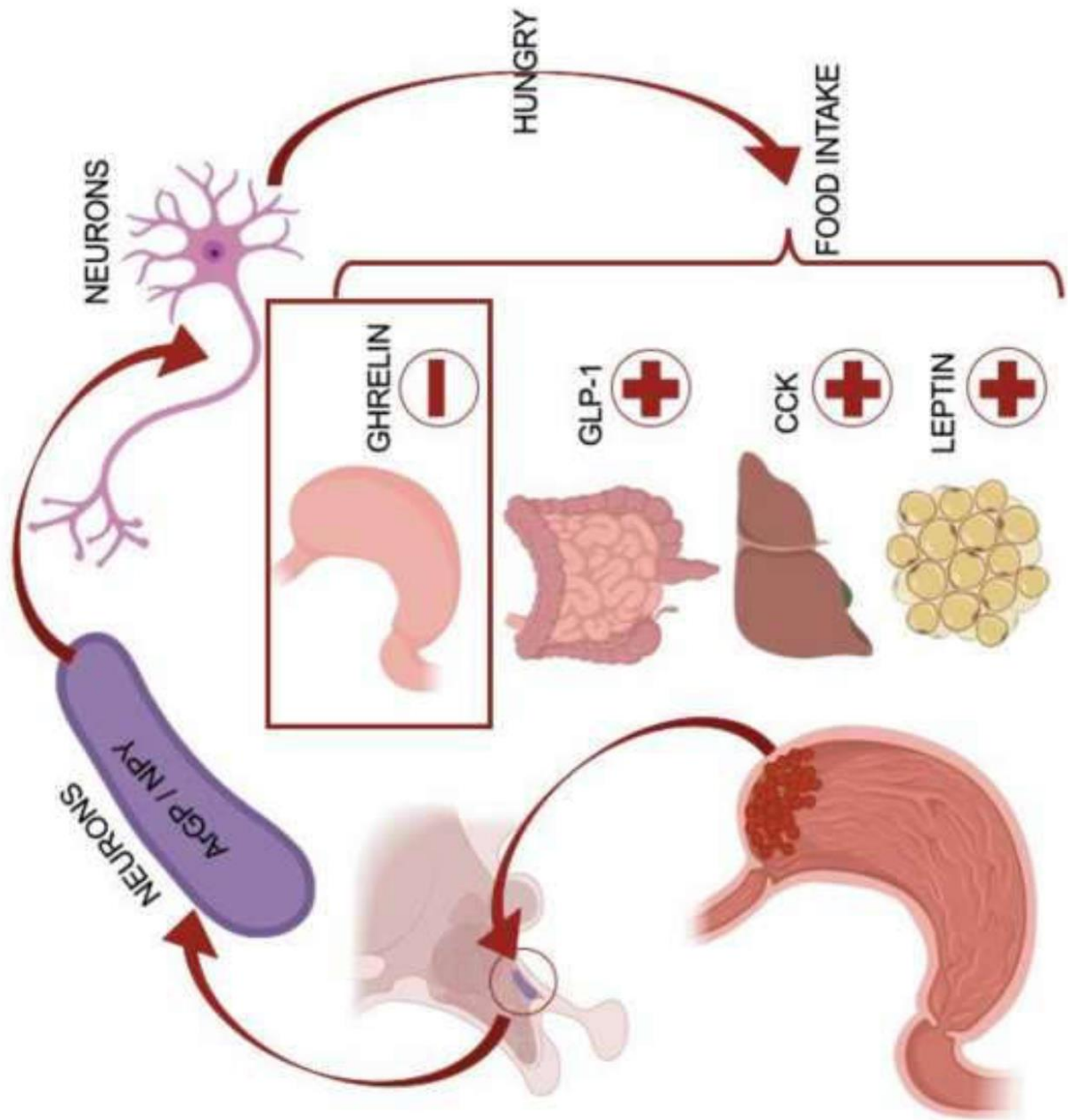


Figure 1
[Click here to download high resolution image](#)

Figure 1

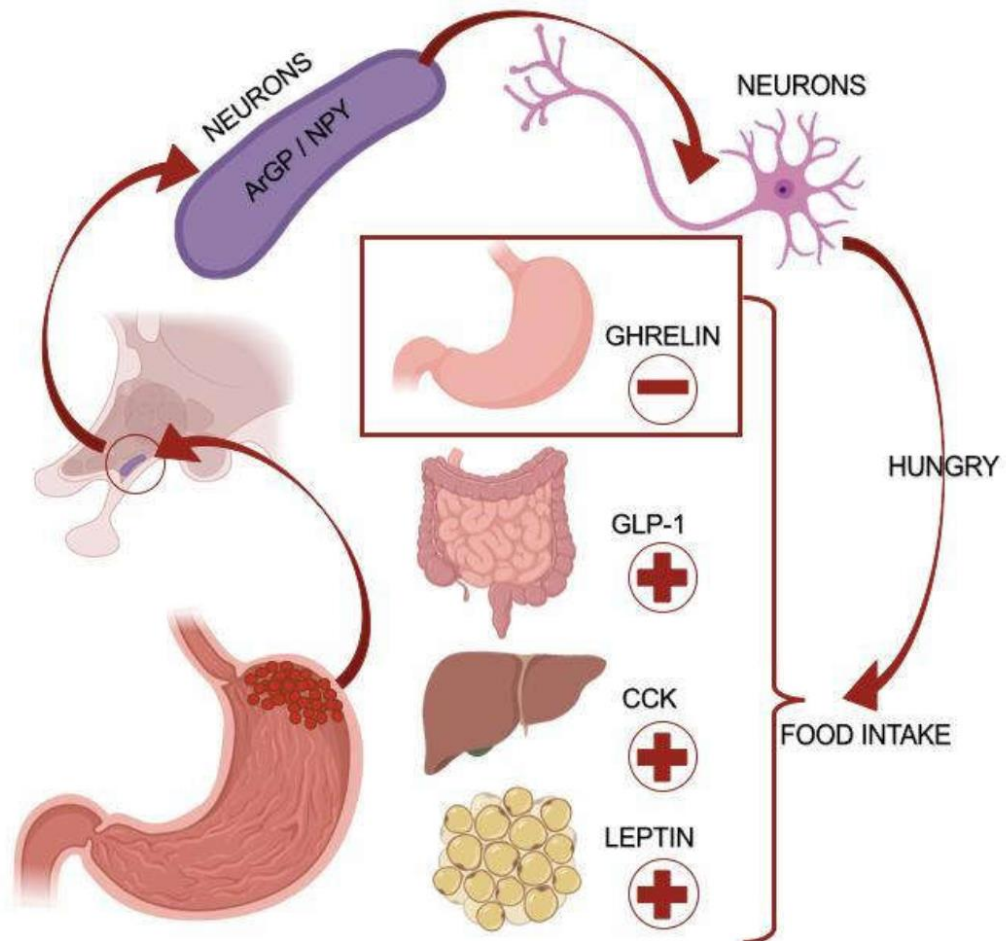


Figure 1 - Role of the regulation of energy homeostasis

With intestinal effect, as the background cells produce ghrelin, which will act on the neuropeptide Y (NPY) and the agouti peptide (AGRP) present in the nuclei of the hypothalamus. Fat release is a release of fat due to the dilation of the stomach and stimulates the release of leptin by adipose tissue, GLP-1 by the intestine and CCK by the liver, responsible for satiety. Ghrelin levels are taxed by a famine.

***Highlights**

1

HIGHLIGHTS**5 LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR
APPETITE SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS**

The use of the interventional technique of embolization of the left gastric artery is already widely used for the treatment of gastrointestinal bleeding. However, this procedure in an elective scenario as treatment of obesity still lacks research to prove long-term efficacy
10 and safety. Several obstacles remain in the way of starting this therapy for main use in weight loss.

6 CONSIDERAÇÕES FINAIS

O interesse e as implicações potenciais de tal procedimento para pacientes obesos são primordiais. Em primeiro lugar, a obesidade é uma epidemia global e as taxas de obesidade, ainda mais para a obesidade grave, ainda estão progredindo. Em segundo lugar, os pacientes obesos geralmente apresentam múltiplas comorbidades, o que pode impedi-los de acessar a cirurgia bariátrica. Nesse cenário, a embolização da artéria gástrica esquerda pode ter um papel fundamental no tratamento desses pacientes. Em terceiro lugar, esse procedimento poderia ser considerado uma ponte para outros procedimentos, como cirurgia cardíaca (revascularização miocárdica, troca valvar ou transplante) ou outros procedimentos abdominais maiores, como sugerido em um relato de caso recentemente publicado descrevendo a embolização da artéria gástrica esquerda em um paciente obeso com carcinoma hepatocelular aguardando cirurgia. A questão de saber se esse procedimento pode ser usado como uma ponte para outros procedimentos bariátricos está longe de ser resolvida.

Talvez seja prematuro demais comparar a eficácia dessa técnica à cirurgia bariátrica, já que os relatos atuais descrevem apenas a experiência com um número limitado de pacientes com durações de seguimento relativamente curtas e diferentes. Além disso, a variabilidade entre esses estudos-piloto é alta (perda de peso média de 3,6% -17,6%). Em comparação, para a cirurgia bariátrica, há uma riqueza de dados que confirmam a perda sustentada (≥ 6 anos) entre 22% e 55% do peso corporal pré-intervenção, dependendo do tipo de cirurgia bariátrica realizada. Da mesma forma, no que diz respeito às complicações, o perfil de segurança da embolização bariátrica não pode ser inferido sobre a limitada experiência disponível com essa técnica. Pelo contrário, as complicações da cirurgia bariátrica têm sido extensivamente estudadas com taxas de mortalidade em 30 dias em torno de ou $<1\%$.

7 REFERÊNCIAS BIBLIOGRÁFICAS

ABESO - Associação Brasileira para o Estudo da Obesidade e da Síndrome Metabólica. **Diretrizes Brasileiras de Obesidade 2016**. 4.ed. São Paulo, 2016.

ARONNE, L. J. et al. When Prevention Fails: Obesity Treatment Strategies. **The American Journal Of Medicine**, [s.l.], v. 122, n. 4, p.24-32, abr. 2009. Elsevier BV. <http://dx.doi.org/10.1016/j.amjmed.2009.01.005>.

BAPTISTA, V.; WASSEF, W. Bariatric procedures. **Current Opinion In Gastroenterology**, [s.l.], v. 29, n. 6, p.684-693, nov. 2013. Ovid Technologies (Wolters Kluwer Health). <http://dx.doi.org/10.1097/mog.0b013e3283651af2>.

BENNETT, J. M. H.; MEHTA, S.; RHODES, M. Surgery for morbid obesity. **Postgraduate Medical Journal**, [s.l.], v. 83, n. 975, p.8-15, 1 jan. 2007. BMJ. <http://dx.doi.org/10.1136/pgmj.2006.048868>.

CAMPOS, J. et al. The role of metabolic surgery for patients with obesity grade and type 2 diabetes not controlled clinically. **Abcd. Arquivos Brasileiros de Cirurgia Digestiva**, São Paulo, v. 29, n. 1, p.102-106, 2016. FapUNIFESP (SciELO). <http://dx.doi.org/10.1590/0102-6720201600s10025>.

CAWLEY, J.; MEYERHOEFER, C. The medical care costs of obesity: An instrumental variables approach. **Journal Of Health Economics**, [s.l.], v. 31, n. 1, p.219-230, jan. 2012. Elsevier BV. <http://dx.doi.org/10.1016/j.jhealeco.2011.10.003>.

COUTINHO, A. K. et al. Orlistat, an under-recognised cause of progressive renal impairment. **Nephrology Dialysis Transplantation**, [s.l.], v. 28, n. 4, p.172-174, 18 set. 2013. Oxford University Press (OUP). <http://dx.doi.org/10.1093/ndt/gft066>.

CUMMINGS, D. E. et al. A Preprandial Rise in Plasma Ghrelin Levels Suggests a Role in Meal Initiation in Humans. **Diabetes**, [s.l.], v. 50, n. 8, p.1714-1719, 1 ago. 2001. American Diabetes Association. <http://dx.doi.org/10.2337/diabetes.50.8.1714>.

CUMMINGS, D. E. et al. Plasma Ghrelin Levels after Diet-Induced Weight Loss or Gastric Bypass Surgery. **New England Journal Of Medicine**, [s.l.], v. 346, n. 21, p.1623-1630, 23 maio 2002. New England Journal of Medicine (NEJM/MMS). <http://dx.doi.org/10.1056/nejmoa012908>.

CUMMINGS, D. E. Ghrelin and the short- and long-term regulation of appetite and body weight. **Physiology & Behavior**, [s.l.], v. 89, n. 1, p.71-84, ago. 2006. Elsevier BV. <http://dx.doi.org/10.1016/j.physbeh.2006.05.022>.

CUMMINGS, D. E.; OVERDUIN, Joost. Gastrointestinal regulation of food intake. **Journal Of Clinical Investigation**, [s.l.], v. 117, n. 1, p.13-23, 2 jan. 2007. American Society for Clinical Investigation. <http://dx.doi.org/10.1172/jci30227>.

ENGLISH, P. J. et al. Food Fails to Suppress Ghrelin Levels in Obese Humans. **The Journal Of Clinical Endocrinology & Metabolism**, [s.l.], v. 87, n. 6, p.2984-2984, jun. 2002. The Endocrine Society. <http://dx.doi.org/10.1210/jcem.87.6.8738>.

FINUCANE, M. M. et al. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. **The Lancet**, [s.l.], v. 377, n. 9765, p.557-567, fev. 2011. Elsevier BV. [http://dx.doi.org/10.1016/s0140-6736\(10\)62037-5](http://dx.doi.org/10.1016/s0140-6736(10)62037-5).

FLEGAL, K. M.. Prevalence and Trends in Obesity Among US Adults, 1999-2008. **Jama**, [s.l.], v. 303, n. 3, p.235-241, 20 jan. 2010. American Medical Association (AMA). <http://dx.doi.org/10.1001/jama.2009.2014>.

GLANDT, M.; RAZ, I.. Present and Future: Pharmacologic Treatment of Obesity. **Journal Of Obesity**, [s.l.], v. 2011, p.1-13, 2011. Hindawi Limited. <http://dx.doi.org/10.1155/2011/636181>.

GONZÁLEZ-MUNIESA, P. et al. Obesity. **Nature Reviews Disease Primers**, [s.l.], v. 3, p.1-18, 15 jun. 2017. Springer Nature. <http://dx.doi.org/10.1038/nrdp.2017.34>.

GREGORCZYK, M.; AGNIESZKA, J.. Arterial supply of gastric fundus in human: Final results. **Medtube Science**, [s. l.], v. 2, n. 3, p.30-34, jun. 2015.

JONES, L R; WILSON, C I; WADDEN, T. A, Lifestyle Modification in the Treatment of Obesity: An Educational Challenge and Opportunity. **Clinical Pharmacology & Therapeutics**, [s.l.], v. 81, n. 5, p.776-779, 14 mar. 2007. Springer Nature. <http://dx.doi.org/10.1038/sj.clpt.6100155>.

KOJIMA, M. et al. Ghrelin is a growth-hormone-releasing acylated peptide from stomach. **Nature**, [s.l.], v. 402, n. 6762, p.656-660, dez. 1999. Springer Nature. <http://dx.doi.org/10.1038/45230>.

KOJIMA, M.; KANGAWA, K. Ghrelin: Structure and Function. **Physiological Reviews**, [s.l.], v. 85, n. 2, p.495-522, abr. 2005. American Physiological Society. <http://dx.doi.org/10.1152/physrev.00012.2004>.

KUMAR, N.; THOMPSON, C. C.. Endoscopic solutions for weight loss. **Current Opinion In Gastroenterology**, [s.l.], v. 27, n. 5, p.407-411, set. 2011. Ovid Technologies (Wolters Kluwer Health). <http://dx.doi.org/10.1097/mog.0b013e328349e240>.

LEE, H. et al. Ghrelin, A New Gastrointestinal Endocrine Peptide that Stimulates Insulin Secretion: Enteric Distribution, Ontogeny, Influence of Endocrine, and Dietary Manipulations. **Endocrinology**, [s.l.], v. 143, n. 1, p.185-190, jan. 2002. The Endocrine Society. <http://dx.doi.org/10.1210/endo.143.1.8602>.

MAAHS, D. et al. RANDOMIZED, DOUBLE-BLIND, PLACEBO-CONTROLLED TRIAL OF ORLISTAT FOR WEIGHT LOSS IN ADOLESCENTS. **Endocrine Practice**, [s.l.], v. 12, n. 1, p.18-28, jan. 2006. AACE Corp (American Association of Clinical Endocrinologists). <http://dx.doi.org/10.4158/ep.12.1.18>.

MADOFF, D. C.. Science to Practice: Can Transarterial Embolotherapy Be Used as a Viable Alternative to Treat Obesity?. **Radiology**, [s.l.], v. 266, n. 2, p.369-371, fev. 2013. Radiological Society of North America (RSNA). <http://dx.doi.org/10.1148/radiol.12122561>.

NGUYEN, N. et al. A Review of Unmet Needs in Obesity Management. **Obesity Surgery**, [s.l.], v. 22, n. 6, p.956-966, 22 mar. 2012. Springer Nature. <http://dx.doi.org/10.1007/s11695-012-0634-z>.

OMS - Organização Mundial de Saúde. **Obesity and overweight**. 2016. Disponível em: <<http://www.who.int/mediacentre/factsheets/fs311/en/>>. Acesso em: 24 mar. 2018.

PORIES, W. J.. Bariatric Surgery: Risks and Rewards. **The Journal Of Clinical Endocrinology & Metabolism**, [s.l.], v. 93, n. 111, p.89-96, nov. 2008. The Endocrine Society. <http://dx.doi.org/10.1210/jc.2008-1641>.

POZZA, C.; ISIDORI, A. M.. What's Behind the Obesity Epidemic. **Imaging In Bariatric Surgery**, [s.l.], p.1-8, 29 jun. 2017. Springer International Publishing. http://dx.doi.org/10.1007/978-3-319-49299-5_1.

REOCH, J. Safety of Laparoscopic vs Open Bariatric Surgery. **Archives Of Surgery**, [s.l.], v. 146, n. 11, p.1314-1322, 1 nov. 2011. American Medical Association (AMA). <http://dx.doi.org/10.1001/archsurg.2011.270>.

STEFATER, M. A.; KOHLI, R.; INGE, T. H.. Advances in the surgical treatment of morbid obesity. **Molecular Aspects Of Medicine**, [s.l.], v. 34, n. 1, p.84-94, fev. 2013. Elsevier BV. <http://dx.doi.org/10.1016/j.mam.2012.10.006>.

TAKIGUCHI, S. et al. Mapping Analysis of Ghrelin Producing Cells in the Human Stomach Associated with Chronic Gastritis and Early Cancers. **Digestive Diseases And Sciences**, [s.l.], v. 57, n. 5, p.1238-1246, 7 dez. 2011. Springer Nature. <http://dx.doi.org/10.1007/s10620-011-1986-2>.

TSCHÖP, M.; SMILEY, D. L.; HEIMAN, M. L.. Ghrelin induces adiposity in rodents. **Nature**, [s.l.], v. 407, n. 6806, p.908-913, 19 out. 2000. Springer Nature. <http://dx.doi.org/10.1038/35038090>.

TYMITZ, K. et al. Changes in Ghrelin Levels Following Bariatric Surgery: Review of the Literature. **Obesity Surgery**, [s.l.], v. 21, n. 1, p.125-130, 23 nov. 2010. Springer Nature. <http://dx.doi.org/10.1007/s11695-010-0311-z>.

VAIDYA, S.; TOZER, K.; CHEN, J. An Overview of Embolic Agents. **Seminars In Interventional Radiology**, [s.l.], v. 25, n. 03, p.204-215, set. 2008. Georg Thieme Verlag KG. <http://dx.doi.org/10.1055/s-0028-1085930>.

VAIRAVAMURTHY, J. et al. Current and cutting-edge interventions for the treatment of obese patients. **European Journal Of Radiology**, [s.l.], v. 93, p.134-142, ago. 2017. Elsevier BV. <http://dx.doi.org/10.1016/j.ejrad.2017.05.019>.

VERDAM, F. J. et al. An Update on Less Invasive and Endoscopic Techniques Mimicking the Effect of Bariatric Surgery. **Journal Of Obesity**, [s.l.], v. 2012, p.1-10, 2012. Hindawi Limited. <http://dx.doi.org/10.1155/2012/597871>.

VIX, M. et al. Evolution of Glycolipid Profile After Sleeve Gastrectomy vs. Roux-en-Y Gastric Bypass: Results of a Prospective Randomized Clinical Trial. **Obesity Surgery**, [s.l.], v. 23, n. 5, p.613-621, 4 dez. 2012. Springer Nature. <http://dx.doi.org/10.1007/s11695-012-0827-5>.

VIX, M. et al. Impact of Roux-en-Y gastric bypass versus sleeve gastrectomy on vitamin D metabolism: short-term results from a prospective randomized clinical trial. **Surgical Endoscopy**, [s.l.], v. 28, n. 3, p.821-826, 7 nov. 2013. Springer Nature. <http://dx.doi.org/10.1007/s00464-013-3276-x>.

WEISS, C. R. et al. Bariatric Embolization of the Gastric Arteries for the Treatment of Obesity. **Journal Of Vascular And Interventional Radiology**, [s.l.], v. 26, n. 5, p.613-624, maio 2015. Elsevier BV. <http://dx.doi.org/10.1016/j.jvir.2015.01.017>.

WEISS, C. R.; KATHAIT, A. S.. Bariatric embolization: a new and effective option for the obese patient?. **Expert Review Of Gastroenterology & Hepatology**, [s.l.], v. 11, n. 4, p.293-302, 20 fev. 2017. Informa UK Limited. <http://dx.doi.org/10.1080/17474124.2017.1294060>.

WILLIAMS, E. P. et al. Overweight and Obesity: Prevalence, Consequences, and Causes of a Growing Public Health Problem. **Current Obesity Reports**, [s.l.], v. 4, n. 3, p.363-370, 28 jun. 2015. Springer Nature. <http://dx.doi.org/10.1007/s13679-015-0169-4>.

WOLF, M.; PARK, S.; SISKIN, G.. Gastric Embolization to Treat Obesity: The rationale behind this therapeutic option for obese patients. **Endovascular Today**, [s.l.], p.65-70, abr. 2014.

WORLD HEALTH ORGANIZATION. **Obesity: preventing and managing the global epidemic**. Report of a World Health Organization Consultation. Geneva: World Health Organization, 2000. 253 p. (WHO Obesity Technical Report Series, n. 894). Disponível em: <http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/>. Acesso em: 26 mar. 2018.

WREN, A. M. et al. Ghrelin Enhances Appetite and Increases Food Intake in Humans. **The Journal Of Clinical Endocrinology & Metabolism**, [s.l.], v. 86, n. 12, p.5992-5992, dez. 2001. The Endocrine Society. <http://dx.doi.org/10.1210/jcem.86.12.8111>.

WREN, A.M.; BLOOM, S.R.. Gut Hormones and Appetite Control. **Gastroenterology**, [s.l.], v. 132, n. 6, p.2116-2130, maio 2007. Elsevier BV. <http://dx.doi.org/10.1053/j.gastro.2007.03.048>.

YOUNG, L. R.; NESTLE, M. The Contribution of Expanding Portion Sizes to the US Obesity Epidemic. **American Journal Of Public Health**, [s. l.], v. 2, n. 92, p.246-249, fev. 2002.

8 ANEXOS

8.1 Normas De Submissão

GUIDE FOR AUTHORS

INFORMATION FOR CONTRIBUTORS

Authors of manuscripts submitted to SURGERY FOR OBESITY AND RELATED DISEASES (SOARD) will receive a timely review and will be notified within two months as to whether their work is accepted, rejected, or requires revision. Submit manuscripts to the SOARD Editorial Office via the Elsevier Editorial System (EES) website for this journal; go to <http://ees.elsevier.com/SOARD> and select "Submit Manuscript". All correspondence regarding submitted manuscripts will be handled via e-mail through EES. Send all other correspondence to:

David Newcombe
Managing Editor

Phone 508-732-6767 x11

Fax 508-732-6766

Email: Obesity@Stellarmed.com

A completed checklist form must accompany each manuscript submitted to soard. Download the checklist [here](#) check all items applicable to your submission. It is an ethical violation to check an item without having responded to it

GENERAL

- ☐ Potential conflicts of interest, whether of a financial or other nature related to the topic of the manuscript, are disclosed by checking the appropriate box on the author agreement form and listing the potential conflicts in an attachment to the author agreement form.
- ☐ Pages are numbered consecutively
- ☐ Lines are numbered consecutively at 5 line intervals throughout the manuscript using the line numbering feature available in word processing software.
- ☐ The article is typed in 12-point type, double-spaced with one-inch margins
- ☐ Title page is uploaded separately (see below for title page requirements)

- ☐ No author or institutional information in the manuscript text

- ☐ Unless a multicenter study, there are no more than 6 co-authors on an Original Manuscript and no more than 3 on a Case Report. Your article will be automatically rejected without review unless you have VERY STRONG EVIDENCE that more than 6 authors are necessary.

- ☐ Only the following abbreviations will be accepted: RYGB or LRYGB for Roux-en-Y Gastric Bypass or Laparoscopic RYGB; BPD for Biliopancreatic Diversion and for BPD with Duodenal Switch, BPD/DS; LAGB for laparoscopic adjustable gastric band; SG for Sleeve Gastrectomy. All abbreviations must be defined when first mentioned in BOTH the Abstract and the Manuscript.

- ☐ Weight loss must be expressed as % Excess Weight Loss (%EWL), using the middle of the 1983 Metropolitan Life Insurance tables for median frame + % Weight Lost (%WL) + % Excess BMI Lost (%EBMIL) with excess > 25 kg/m²

- ☐ Studies in humans require informed consent and approval from the local Institutional Review Board (IRB) and in animals from the Animal Care and Use Committee and is addressed in the Materials and Methods section.

- ☐ Permission to reprint material from another source in print and electronic form has been obtained.

- ☐ If a clinical trial, it was registered in the National Institutes of Health web site: www.clinicaltrials.gov. or one of the equivalent web sites such as: <http://www.anzctr.org.au>; <http://www.clinicaltrials.gov>; <http://isrctn.org> <http://www.trialregister.nl/trialreg/index.asp>; or <http://www.unin.ac.jp/ctr>. This information has been stated in both the Cover Letter and the Materials and Methods section of the manuscript.

- ☐ For randomized controlled trials, a completed CONSORT checklist accompanies the manuscript. Download at: http://www.consort-statement.org/mod_product/uploads/CONSORT%202001%20checklist.pdf

☐ For studies of diagnostic accuracy, a completed STARD checklist accompanies the manuscript. Download at: http://www.stard-statement.org/checklist_maintext.htm

☐ For meta-analyses and systematic reviews of randomized controlled trials, the PRISMA guidelines are followed. Download at: <http://www.prisma-statement.org/2.1.2%20-%20PRISMA%202009%20Checklist.pdf>

☐ For meta-analyses and systematic reviews of observational studies, the MOOSE guidelines are followed. Download at: <http://www.editorialmanager.com/jognn/account/MOOSE.pdf>

☐ For observational studies, a completed STROBE checklist accompanies the manuscript. Download at: <http://www.who.int/bulletin/volumes/85/11/07-045120.pdf>

COVER LETTER

☐ A cover letter is submitted indicating the intent to submit to Surgery for Obesity and Related Diseases.

☐ Publication elsewhere (including electronic media) of any of the material in the manuscript submitted, other than an abstract of not more than 300 words, is identified and a copy of the other publication is submitted to the editorial office.

☐ If a version of the manuscript has previously been submitted for publication to Surgery for Obesity and Related Disease, comments from the peer reviewers and an indication of how the authors have responded to these comments are included.

TITLE PAGE

☐ The title, author name(s) and major degree(s), affiliation(s), and the source(s) of funding for the work or study are provided.

☐ The name, address, telephone and fax numbers, and e-mail address of the corresponding author are given.

- ☐ The manuscript title is no longer than 150 characters (letters and spaces) and does not contain any abbreviations or acronyms.
- ☐ A short title (no more than 50 characters) is provided at the bottom of the page for use as a running foot.
- ☐ The only acknowledgments are of financial or other substantive assistance. All individuals named in the acknowledgments have given written permission to be named.

ABSTRACT (for original and review articles only)

- ☐ For original research reports and review articles, the abstract is limited to 250 and 300 words, respectively, and in the case of original articles follows the appropriate structured abstract format. Review articles do not require a structured format. Abstracts are not used in Case reports, Controversial Issues, Surgeon at Work and Updates.
- ☐ If the research identified important variables that lacked statistical difference, the study's power to detect such difference is addressed in the abstract.
- ☐ Footnotes, references, and commercial names are not used in the abstract.
- ☐ The abstract precedes the manuscript document.
- ☐ Keywords are added at the end.

REFERENCES

- ☐ References correspond to the specifications of the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals." Examples of specific types of references are available at: http://www.elsevier.com/wps/find/journaldescription.cws_home/703772/authorinstructions

- ☐ References are identified on the line within parentheses in superscript, e.g, Schauer et al. (3).
- ☐ Each reference is cited in the text.
- ☐ References are numbered consecutively in the order in which they appear in the text.
- ☐ ALL authors have been listed when 6 or less. Only when more than 6, should the first 3 authors be listed followed by "et al."
- ☐ Unpublished data, personal communications, submitted manuscripts, statistical programs, papers presented at meetings, and non–peer-review publications are not listed in the reference list.

TABLES

- ☐ Each table is on a separate sheet of paper with its title and uploaded separately from the manuscript.
- ☐ Tables are numbered with Arabic numerals, e.g. Table 1, Table 2.
- ☐ Each table contains all necessary information in order that it may stand alone, independent of the text, including definitions of all abbreviations in the table in a legend beneath the table.
- ☐ No table repeats all data presented in the text.

FIGURES

- ☐ Digital art guidelines and artwork checklist on the journal's web site (http://www.elsevier.com/framework_authors/Artwork/Artwork_2010.pdf) have been consulted.
- ☐ Each figure is cited in the text.

- ☐ Figures have a minimum width of 3¼ inches and height of 2 inches.
- ☐ Images are submitted in TIFF (Tagged Image File Format) or EPS (Encapsulated PostScript) formats
- ☐ Letters and identifying marks (e.g. arrows) are clear and sharp, and the critical areas of radiographs and photomicrographs are identified. All figures and edited tables use at least 300 DPI
- ☐ All text that may identify a patient, including initials of the patient's name) is removed.
- ☐ Explanatory material appears in the accompanying legend and not on the figure itself, including definitions of all abbreviations in the figure in a legend beneath the table.
- ☐ Legends are listed on one page at the end of the manuscript and must have definitions for all abbreviations.
- ☐ Each figure is uploaded separately from the manuscript
- ☐ I understand that color figures are welcome and will appear in color on the web at no extra charge; however, there is a charge for the reproduction of color illustrations in print (\$650 for the first color figure and \$100 for each additional color figure) unless you request an exception and it is waived by the Editor and Publisher. Alternatively, the illustrations can be reproduced in print in black and white at no extra charge. Be sure that charts and graphs have been designed with this in mind so that the data are clear when published in black and white, i.e. different formats for the different columns (clear, hash marks, stippled, etc.) or graphic lines (solid, dashed, dotted, etc.).
- ☐ I plan on paying for color images

Manuscripts should be prepared in accordance with the Uniform Requirements for Manuscripts Submitted to Biomedical Journals, available at: <http://www.icmje.org> . Studies in humans require approval from the local Institutional Review Board (IRB) and in animals from the Animal Care and Use Committee. All clinical trials must be

registered in the National Institutes of Health web site: www.clinicaltrials.gov. or one of the equivalent web sites such as:

<http://www.anzctr.org.au>;

<http://www.clinicaltrials.gov>;

<http://isrctn.org>

<http://www.trialregister.nl/trialreg/index.asp>;

<http://www.umin.ac.jp/ctr>.

This information must be stated in both the Cover Letter and the Materials and Methods section of the manuscript.

Previous Publication or Duplicate Submission:

Manuscripts are considered with the understanding that they have not been published previously in print or electronic format and are not under consideration by another publication or electronic medium. Copies of possibly duplicative materials (ie, those containing substantially similar content or using the same or similar data) that have been previously published or are being considered elsewhere must be provided at the time of manuscript submission.

Previous Presentation or Release of Information:

A complete report following presentation at a meeting or publication of preliminary findings elsewhere (e.g. an abstract) can be considered. Media coverage of meeting presentations will not jeopardize consideration, but direct release of information through press releases or news media briefings may preclude consideration by SOARD.

Avoiding Pejorative Language

Importantly, authors should not use “obese” as an adjective or noun to describe an individual person or group of people, but instead use terms such as “people with obesity” and “populations with obesity.”

Authorship:

In accordance with the ICJME statement on authorship, "An author just generally considered to be someone who has made substantive intellectual contributions to the published study". The ICMJE recommends that authorship be based on the following four criteria: • Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND • Drafting the work or revising it critically for important intellectual content; AND • Final approval of the version to be published; AND • Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. When the manuscript is submitted, the corresponding author will be asked to state that each has met these criteria.

Conflict of Interest:

All authors must disclose any conflict of interest they may have with an institution or product that is mentioned in the manuscript and/or is important to the outcome of the study presented. This would include funding for the research, membership in any speaker's bureau or corporate advisory committee, stockholder, or support for travel ([click here to see entire list](#)). Authors should also disclose conflict of interest with products that compete with those mentioned in their manuscript. The Editor will discuss with the authors on an individual basis the method by which any conflicts of interest will be communicated to readers. Manuscripts without conflicts of interest disclosure from all authors will be returned. Download the conflict of interest form [here](#).

Editing services:

SOARD publishes manuscripts only in American English. This includes using US spelling, punctuation, quotation marks, and decimal points. SOARD editors strongly encourage contributors whose English is not excellent to have their manuscripts edited by a professional translator or native English speaker before submission. Elsevier offers authors two services to help prepare their manuscripts for submission to an English-language journal. The first service edits your manuscript already written in English to ensure it is in correct scientific English. This process does not change the content of your manuscript but improves understanding and readability

for an English-speaking reader. This process takes less than six business days and the cost of an average manuscript is less than \$400. Please visit WebShop Language Services for more details and to upload your manuscript. The second service translates your manuscript from your language (Chinese, Portuguese or Spanish) into either British or American English. This process is carried out by Language experts within your field, and takes less than 11 business days. The average cost is \$1,000. Please visit WebShop Language Services for more details and to upload your manuscript.

Open access:

The open access publication fee for this journal is USD 3400, excluding taxes. Authors now have the option to make their full-length articles available to all (including non-subscribers) via the ScienceDirect platform, for which a fee of USD 3400 applies (for further information on open access see <http://www.elsevier.com/about/open-access/open-access-options>). Please note that you can only make this choice after receiving notification that your article has been accepted for publication, to avoid any perception of conflict of interest. The fee excludes taxes and other potential costs such as color charges. Learn more about Elsevier's pricing policy: <https://www.elsevier.com/openaccesspricing>. All accepted case reports will be published as open access with an article processing fee of USD 750.

Green open access:

Authors can share their research in a variety of different ways and Elsevier has a number of green open access options available. We recommend authors see our green open access page for further information (<http://elsevier.com/greenopenaccess>). Authors can also self-archive their manuscripts immediately and enable public access from their institution's repository after an embargo period. This is the version that has been accepted for publication and which typically includes author-incorporated changes suggested during submission, peer review and in editor-author communications. Embargo period: For subscription articles, an appropriate amount of time is needed for journals to deliver value to subscribing customers before an article becomes freely available to the public. This is the embargo period and begins from the publication date of the issue your article

appears in. This journal has an embargo period of 12 months. SOARD publishes the following types of articles in addition to standard research manuscripts:

1. **IMAGES IN OBESITY SURGERY:** Concise, one-page pictorial description of a unique case will be published as space permits.
2. **SURGEON AT WORK:** Short, concise articles plus photos and/or drawings on: "How I do it" techniques will be published as space permits.
3. **CASE REPORTS:** SOARD will only consider non-video case reports if they will be of GREAT IMPORTANCE to the field of bariatric surgery. Beginning May 1, 2017, non-video case reports will incur an article processing fee of \$750, and they will be printed in the journal. Case Reports need to conform to the following Guidelines: it must contain an Introduction, Case Presentation and Management and Discussion without an abstract.
4. **VIDEO CASE REPORTS:** Video case reports will receive high priority. The video presentation must include a title slide, a clinical case history (one slide), and a final "technical vignettes" slide, in addition to narration. The text should include a brief clinical case history, with a focused description of techniques and vignette; the diagnostic imaging modalities before and after the procedure; and the patient status at last follow up. The total word count for text should be less than 350 words.
5. **REVIEW ARTICLES:** This comprehensive review-type article covers timely bariatric surgery topics of clinical relevance and must be well-referenced. These articles should serve as a source on a clinically useful subject for the practicing bariatric surgeon, primary care physician, nutritionist, psychiatric specialist, obesity investigator and resident or fellow-in-training of current information.
6. **UPDATES:** This shorter review-type article covers current obesity topics of clinical relevance.
7. **EDITORIALS/PAIRED EDITORIALS:** These will be solicited by the Editor and should not be submitted without prior written approval.

8. **LETTERS TO THE EDITOR:** Short communications regarding recent articles or comments on timely topics in letter form that should be supported by relevant references. Authors of the cited article will have the opportunity to read and reply to the letter. ALL LETTERS TO THE EDITOR must be submitted within one month of the publishing date of the cited article. Letters if accepted will be published as space permits.

9. **CONTROVERSIAL ISSUES:** These are articles dealing with controversial topics such as: Is bariatric surgery appropriate in patients with schizophrenia or bi-polar disorders? Which should come first in the morbidly obese patient with chronic renal failure: renal transplant or bariatric surgery? How do you manage the patient with an anatomically intact, non-obstructive Roux-en-Y gastric bypass who "can't eat"? They can be associated with a case report or just present a philosophical or reasoned medical approach. Abstracts are optional. Subsequent "letters to the editor" will be welcome.

10. **INTEGRATED HEALTH ARTICLES:** A section for Integrated Health manuscripts will be published periodically during the year. These manuscripts should be related to nursing, nutritional, exercise and psychological issues relevant to bariatric surgery.

Editorial Process

PEER REVIEW: Manuscripts will be reviewed by internationally recognized experts on the subject. When relevant, a biostatistician, radiologist, psychological specialist, nutritionist, or pathologist consultant will also review the manuscript. This journal operates a single blind review process. All contributions will be initially assessed by the editor for suitability for the journal. Papers deemed suitable are then sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's decision is final. More information on types of peer review. The reviewers will be blinded to the names of the authors and the institution and country from which the manuscript has been sent. Reviewers will be asked to list all current Conflicts of Interest ([click here to see entire list](#)) and comment if any of these or other conflicts are associated with the manuscript you are being asked to review.

Submission Process

Manuscripts must be submitted via the Elsevier Editorial System (EES) website for this journal; go to <http://ees.elsevier.com/SOARD> and select "Submit Manuscript". You will be guided stepwise through the creation and uploading of the various files and data. Once the uploading is done, the system automatically generates an electronic (PDF) proof, which is then used for reviewing. All correspondence regarding submitted manuscripts will be handled via e-mail through EES. The article must be typed in 12-point type, double-spaced with one-inch margins (with all pages numbered consecutively) and line numbers inserted at every 5 lines. The file should follow the general instructions on style/arrangement, and, in particular, the reference style. The file should use the wrap-around end-of-line feature, i.e. returns at the end of the paragraph only. Place two returns after every element, such as title, headings, paragraph. Please do NOT use any automatically generated numbering or bulleting systems or hidden text (e.g. For references, footnotes, lists). Unless specifically indicated in the various categories listed, each manuscript must contain an Abstract and Introduction, Materials and Methods, Results, Discussion, Conclusions and References sections, with the appropriate subheading preceding each section. The title should be brief, informative, of 150 characters or less and should not make a statement or conclusion. The running title should consist of not more than 50 letters and spaces. It should be as brief as possible, convey the essential message of the paper and contain no abbreviations.

Graphical Abstract

A graphical abstract should allow readers to quickly gain an understanding of the main take-home message of the paper and is intended to encourage browsing, promote interdisciplinary scholarship, and help readers identify more quickly which papers are most relevant to their research interests. Graphical abstracts can be uploaded selecting "Graphical Abstract" when uploading files. The graphical abstract is designed to give readers an immediate understanding of the take-home message of the paper. Its intent is to encourage browsing, promote interdisciplinary scholarship, and help readers quickly identify which papers are most relevant to their research interests. Graphical abstracts should be submitted as a separate file in the online submission system. Image size: Please provide an image with a minimum of 531 ×

1328 pixels (h × w) or proportionally more. The image should be readable at a size of 5 × 13 cm using a regular screen resolution of 96 dpi. Preferred file types: TIFF, EPS, PDF or MS Office files. You can view Example Graphical Abstracts on our information site. Authors can make use of Elsevier's Illustration and Enhancement service to ensure the best presentation of their images and in accordance with all technical requirements: Illustration Service

Highlights

Highlights are a short collection of bullet points that convey the core findings of the article. This list of points will be displayed online with the Summary of the article but will not appear in print. Specifications: up to four bullet points can be included; the length of an individual bullet point should not exceed 85 characters (including spaces); only the core results of the paper should be covered. Highlights are required for all research papers and will be displayed online with the article.

Structured Abstracts should be 250 words or less and divided into five sections with the subheadings: (1) Background (2) Objectives, (3) Setting (i.e. University Hospital, United States; Private Practice), (4) Methods, (5) Results, and (6) Conclusions. Using lower-case superscript letters, link each author with the appropriate affiliation. Measurements of length, height, weight and volume should be reported in metric units. Weight loss should be reported in kg lost, BMI reduction, percent weight lost and percent excess weight lost with excess weight defined as that above the median weight for height in the Metropolitan Life Insurance tables. Laboratory data should be reported in both the local and International System of Units (SI). Manuscripts must be accompanied by a cover letter, which should include a statement about submissions that might be regarded as redundant publication, a statement about financial or other relationships that might lead to a conflict of interest, a statement that the manuscript has been read and approved by all authors, and contact information for the corresponding author. Include the full names, degrees and affiliations of all authors on the title page and upload separately from the manuscript. Do not include any author contact information within the manuscript. Please also include key words with your submission. Manuscripts with incorrect format or that are over maximum length will be returned unreviewed for modifications (see table for correct format/length). Weight loss must be expressed as change in BMI, AS WELL

AS % Excess Weight Loss (%EWL), with the calculation of ideal body weight as that equivalent to a BMI of 25 kg/m² and/or % Excess BMI Lost (%EBMIL) with excess BMI > 25 kg/m² AS WELL AS % total body weight loss. Data extending beyond 30 days MUST INCLUDE lost to follow-up information in the Abstract and Results section, including all tables and figures, with the denominator provided as to how many patients were available at EACH TIME POINT and the number of patients actually seen. TABLES: Each table should be counted as 250 words toward the final word count. Tables should supplement, not duplicate the text/figures. The tables must be numbered and cited in order as they first appear in the text, and each must have a precise heading the understanding of which does not require reference to the text. Do not imbed tables with the text. ILLUSTRATIONS: Each figure should be counted as 250 words toward the final word count. Color figures are welcomed, and will appear in color on the web at no extra charge; however, there is a charge, paid in advance, for the reproduction of color illustrations in print (\$650 for the first color figure and \$100 for each additional color figure) unless waved by the Editor and Publisher. Alternatively, the illustrations can be reproduced in print in black and white at no extra charge. All illustrations must supplement, not duplicate the tables/text. Figures must clearly convey their message and be of high quality and of sufficient size and clarity (especially lettering, arrows, and data points) to be interpretable when reduced for publication. Shading does not always reproduce well. Consider using widely spaced cross-hatching patterns, for example, that will remain distinct on reduction. Use black and white arrows, depending on the background color. All illustrations must be numbered and cited in order as they first appear in the text. Concise legends (typed on a separate page) must accompany each illustration and adequately describe the figure without the need to reference to the text. Do not embed artwork with text; illustrations should be supplied as separate files. Guidelines for submitting your illustrations in an electronic format can be found at <http://ees.elsevier.com/SOARD>. VIDEO/COMPUTER GRAPHICS: An original, edited file in IBM compatible PC format will be the standard format for submission of videos and computer graphics (i.e., slide presentations with or without animation). SOARD will not edit any video or computer graphics, but reviewers, following the usual policy with illustrations, may suggest changes in the video or computer graphic. A soundtrack is highly recommended. Maximum cumulative length of videos or computer graphics is 8 minutes and may be divided into several smaller clips not to exceed 8 minutes in total. If the video or animation is divided into

several clips, each clip should be identified at the beginning of the section: e.g., Video Clip 1 or Graphic 1. The maximum file size is 700 MB. Concise legends (typed on a separate page) must accompany each video clip or computer graphic presentation. The following formats for video will be accepted: MPEG-1 or MPEG-2 (.mpg), Quicktime (.mov), Audio/Video Interface (.avi) or Compuserve GIF (.gif). Please contact the publisher about the use of other formats. A graphic will be used to indicate the location of a video clip or computer graphic. Videos/computer graphics for accepted manuscripts will not be returned. Videos and computer graphics will not be accepted separately from a manuscript that has been rejected. If the article is accepted for publication, the video will be digitized and permanently archived on the SOARDwebsite (<http://ees.elsevier.com/SOARD>). The location of the video on the World Wide Web will be linked with the online version of the article. PERMISSION: Authors must submit written permission upon manuscript submission from both the author and publisher of the original source when material is reproduced from other sources. This permission must include reproduction in both print and electronic formats for worldwide distribution. ACKNOWLEDGEMENTS: Acknowledgement(s) require written permission of the person being acknowledged. REFERENCES: References must be limited to those cited in the text, be numbered consecutively in the order in which they are first mentioned, with their positions indicated in the text by a superscript Arabic number. Any authors beyond six will be replaced by et al. References to articles in press must state journal name and year. Personal Communications will not be included in the reference list and should be accompanied with written verification and be noted within the text. Authors are responsible for the accuracy and completeness of their references and for correct text citation. For journal articles: Surname and initials of author(s). If there are 6 or fewer authors, all authors need to be listed. If there are more than 6 (7+), then only list the first 3 followed by "et al." Title of article. Abbreviated name of Journal, year; volume(number): first and last pages. For example:

1. Fetner R, McGinty J, Russell C, Pi-Sunyer FX, LaFerrere B. Incretins, diabetes, and bariatric surgery: a review. *Surg Obes Rel Dis* 2005;1(6):589-99.

2. Nguyen NT, Goldman C, Rosenquist CJ, et al. Laparoscopic versus open gastric bypass: a randomized study of outcomes, quality of life, and costs. *Ann Surg* 2001;234(3):279-89. For Books: Surname and initials of author(s), title and subtitle, edition (other than first). City, publishing house, year, and pages as specific reference, as follows:

1. Mason EE. Surgical Treatment of Obesity. Philadelphia, London, Toronto, W.B. Saunders Company, 1981 pp 1-493.

For articles or chapters in books: Surname and initials of author(s), title of article/chapter, surname and initials of editor, title of book. City, publishing house, year, and pages, as follows:

1. Brolin RE, Metabolic postoperative complications after bariatric surgery. In Martin LF (ed), Obesity Surgery, New York, McGraw-Hill, 2004, pp 275-300.

Research data

This journal encourages and enables you to share data that supports your research publication where appropriate, and enables you to interlink the data with your published articles. Research data refers to the results of observations or experimentation that validate research findings. To facilitate reproducibility and data reuse, this journal also encourages you to share your software, code, models, algorithms, protocols, methods and other useful materials related to the project.

Below are a number of ways in which you can associate data with your article or make a statement about the availability of your data when submitting your manuscript. If you are sharing data in one of these ways, you are encouraged to cite the data in your manuscript and reference list. Please refer to the "References" section for more information about data citation. For more information on depositing, sharing and using research data and other relevant research materials, visit the research data page.

Data linking

If you have made your research data available in a data repository, you can link your article directly to the dataset. Elsevier collaborates with a number of repositories to link articles on ScienceDirect with relevant repositories, giving readers access to underlying data that gives them a better understanding of the research described. There are different ways to link your datasets to your article.

When available, you can directly link your dataset to your article by providing the relevant information in the submission system. For more information, visit the database linking page .

For supported data repositories a repository banner will automatically appear next to your published article on ScienceDirect.

In addition, you can link to relevant data or entities through identifiers within the text of your manuscript, using the following format: Database: xxxx (e.g., TAIR: AT1G01020; CCDC: 734053; PDB: 1XFN).

Mendeley Data

This journal supports Mendeley Data, enabling you to deposit any research data (including raw and processed data, video, code, software, algorithms, protocols, and methods) associated with your manuscript in a free-to-use, open access repository. Before submitting your article, you can deposit the relevant datasets to Mendeley Data. Please include the DOI of the deposited dataset(s) in your main manuscript file. The datasets will be listed and directly accessible to readers next to your published article online. For more information, visit the Mendeley Data for journals page.

Data statement

To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process, for example by stating that the research data is confidential. The statement will appear with your published article on ScienceDirect. For more information, visit the Data statement page. PROOFS: To avoid publication delay, authors must return proofs in 48 hours. RESPONSIBILITY: Manuscripts are subject to editorial modification to bring them into conformity with the style of the journal. Statements in articles or opinions expressed by any contributor in any article, including changes made by the copy editor and approved by the corresponding author, are not the responsibility of the editors or the publishers.

8.2 Comprovante de Submissão



Mateus Nunes Carvalho <mateusnunes@gmail.com>

A manuscript number has been assigned to your submission

1 mensagem

SOARD <eesserver@eesmail.elsevier.com>
 Responder a: SOARD <Obesity@stellarmed.com>
 Para: mateusnunes@gmail.com

Ms. Ref. No.: SOARD-19-238
 Title: LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR APPETITE SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS
 Surgery for Obesity and Related Diseases

Dear Mateus,

Your submission entitled "LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR APPETITE SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS" has been assigned the following manuscript number: SOARD-19-238.

You may check on the progress of your paper by logging on to the Elsevier Editorial System as an author. The URL is <https://ees.elsevier.com/soard/>.
 Your username is: mateusnunes@gmail.com

If you need to retrieve password details, please go to: http://ees.elsevier.com/soard/automail_query.asp

Thank you for submitting your work to this journal.

Kind regards,

David Newcombe
 Managing Editor
 Surgery for Obesity and Related Diseases

Abstracts and tables of contents are free to all viewers. Full Text is free to ASMBs and SBCBM members and individual subscribers. Register online at <http://soard.org/>

Buy journal subscriptions and books, check the "Weekly Featured Journal" and "Video of the Month", or stay up-to-date with the most recent Surgery Articles in Press. All in one place: WWW.SURGERYADVANCE.COM!

SURGERY FOR OBESITY AND RELATED DISEASES

Contact us Help

Username: mateusnunes@gmail.com
 Switch To: Author Go to: [My EES Hub](#)

[home](#) | [main menu](#) | [submit paper](#) | [guide for authors](#) | [register](#) | [change details](#) | [log out](#)

Version: EES 2019.5

Submissions Being Processed for Author Mateus Nunes Carvalho

Page: 1 of 1 (1 total submissions)

Display 10 results per page.

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
Action Links	SOARD-19-238	LEFT GASTRIC ARTERY EMBOLIZATION AS AN ALTERNATIVE FOR APPETITE SUPPRESSION AND WEIGHT LOSS IN OBESE PATIENTS	May 22, 2019	May 28, 2019	Under Review

Page: 1 of 1 (1 total submissions)

Display 10 results per page.

<< Author Main Menu

