Laparoscopic Adaptive Gastro-omentectomy as an Early Procedure to Treat and Prevent the Progress of Obesity

- Evolutionary and Physiological Support

Gastro-omentectomia Laparoscópica Adaptativa: Novo Procedimento para Tratamento e Prevenção do Avanço da Obesidade - Bases Fisiológicas e Evolucionárias

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ABSTRACT

OBJECTIVE: This is the preliminary report of a new surgical technique to treat and prevent the progress of obesity: Laparoscopic Gastro-Omentectomy. The first case, the evolutionary and physiological support to this technique are shown. METHOD: The technique includes a hand-assisted laparoscopic vertical (sleeve) gastrectomy and omentectomy. RESULTS: A patient with BMI of 36 Kg/m² was submitted to the procedure, discharged 48 hours after, with no complaints. To date this patient lost 13 kg in 30 days following the procedure and reports early satiety. CONCLUSIONS: This is the preliminary report of a technique designed to abort the evolution of obesity. The procedure does not create sub occlusions; no prostheses are used and there are no excluded segments. Neither malabsorption nor blind endoscopic areas are generated and, fundamentally, no harm is done to important digestive functions. Instead, it causes a modest gastric restriction that promotes early satiety by distension and the procedure removes sources of three important agents involved with obesity and its comorbidities: Ghrelin, Plasminogen Activator Inhibitor-1 (PAI-1) and Resistin. The operated patient will not need nutritional support or to take pills chronically. The procedure is simple, fast and safe to perform.

Key words: OBESITY/surgery; MORBID OBESITY; OMENTUM/ surgery; GASTRECTOMY; GASTROPLASTY; ghrelin, human; resistin; PAI-1; ADIPOSE TISSUE.

SANTORO S, VELHOTE MCP, MECHENAS ASG, MALZONI CE, STRASSMANN V. Laparoscopic Adaptive Gastro-omentectomy as an Early Procedure to Treat and Prevent the Progress of Obesity. Evolutionary and Physiological Support. Rev bras videocir 2003;1(3):96-102. A recent change in human diet increased the participation of high caloric dense food that is also easy to digest and absorb. In the last thirty years food abundance became common and it has led to a huge increase in the incidence of obesity, hypertension, diabetes, hypertriglyceridemia, hypercholesterolemia, and other conditions associated with obesity. Nutritional Education and Medical Treatments are failing in avoiding obesity, which led to the appearance of many techniques for surgical treatment of extreme obesity. However, none of these techniques is easy, safe, or physiologically correct enough to be applied early in the development of obesity.

Extreme obesity is a personal tragedy. When it is present, the patient already has damaged arteries, heart, joints, skin, etc. Also, substantial psychological damage occurs during the long process of weight gain. Current surgical treatment is so aggressive that it can only be offered when extreme obesity is present. Malabsorption, obstacles to food ingestion, prosthesis to cause sub occlusions, and excluded segments are troublesome. If we had a physiological, simple, easy and safe method that could help stop the weight gain and start some weight loss, without damage to digestive functions, we could possibly apply it sooner. We could then, in effect, act soon and interfere less. The procedure we are going to present here, in a preliminary report, is the first step of a new strategy to face obesity, based on a new concept called "Evolutionary Surgery". This strategy, ongoing since October 2002, creates different procedures for different stages and types of obesity. This first step we are going to describe is very simple and is based in physiological and evolutionary data.

Physiological Background

Ghrelin: This is a 28-amino peptide, predominantly produced by the stomach, which displays strong growth hormone (GH)-releasing activity, but also stimulates gastric acid secretion, and is able to induce adiposity by activating a central mechanism for increasing food intake and decreasing fat utilization ^{1, 2, 3}. After a meal, ghrelin production falls. As time passes after the last meal, its production is enhanced and it has been shown that this participates in the genesis of hunger ⁴. High level of ghrelin is not a common cause for obesity since it was shown that obese people have low levels of this hormone, however, when significant weight loss occurs, ghrelin levels go high, generating hunger and this is, probably, a motive for weight regain 5.

PAI-1: Plasminogen activator inhibitor 1 (PAI-1) is the primary physiological inhibitor of plasminogen activation, which means it is a procoagulant factor. Circulating PAI-1 levels are elevated in patients with coronary heart disease and it plays an important role in development of atherothrombosis by decreasing fibrin degradation ⁶. PAI-1 is produced mainly by visceral fat tissue, mainly the omentum and mesenteric fat ^{6, 7, 8}. Procedures that cause reduction in PAI-1 levels have already been pointed to improve metabolic profile and reduce the cardiovascular risk ^{9, 10}.

Resistin: It is clear today that adipose tissue is an endocrine gland and it produces many substances that can act like hormones, such as leptin, interleukin-6, adiponectin (also called ACRP30 and adipoQ), angiotensin II and resistin. Resistin acts on skeletal muscle myocytes, hepatocytes, and adipocytes themselves, reducing their sensitivity to insulin and it is linked to diabetes ^{11, 12}. Abdominal fat is a main source of resistin^{12, 13}.

Visceral obesity: The fat tissue in the abdomen was clearly linked with what was called Plurimetabolic syndrome. The waist to hip relation has been used to quantify cardiovascular risk and many epidemiological studies have pointed its relation to high blood pressure, hypertriglyceridemia, insulin resistance and atherothrombotic disease. Visceral fat is insulin resistant and so, it keeps releasing free fatty acids (FFA) to the portal system. It is believed that insulin resistance of the liver derives from a relative increase in the delivery of FFA from the omental fat depot to the liver (via the portal vein)¹⁴. Many extreme obese patients have quite good metabolic profile because they have mostly subcutaneous fat, while it is also clear that, except by the orthopedic, respiratory and reflux complications, most metabolic complications of obesity are related to visceral fat.

Evolutionary Background

Primitive diet was raw, full of poorly digestible fiber, very hypocaloric and highly contaminated. Big volumes of primitive diet may have been isocaloric when compared to very small volumes of modern diet. Stomachs were developed over time and they were prepared to deal with primitive food. Our ancestors did not live in abundance and when facing good food, the eating instinct was designed to eat enough also to create a stockpile for long periods of starvation. So, ingested volumes had to be massive and stomachs had to be big to fit and process more food. Intense acid production was necessary to diminish the bacterial content of food. In the stomach osmolarity of ingested food is corrected and gastric emptying occurs gradually and in a regulated manner, due to a neuroendocrine controlled pylorus.

Then, in a few centuries the human diet was deeply changed. Fire control made food more digestible. Agriculture gave us some abundance and enhanced the participation of carbohydrates. Refined sugar gave us in volume what nature could only give us in minimal portions. Saturated fat and industrialized food worsened the picture. Development of electric energy allowed us to also eat at night. Marketing, restaurants, cookies, and the other "goodies" of Civilization represented a too fast change that our Digestive system and our eating instincts could not follow.

Modern diet is hypercaloric, poor in fiber, easy to absorb and very little contaminated. In the current environment, it seems that the gastric chamber is indeed too big and acid production perhaps excessive.

Evolutionary Surgery - First step

We have been looking for ways we could adapt the digestive system and the overeating instincts without causing damage to precious digestive functions, like gastric, pyloric, duodenal, ileal and colonic. Duodenum and proximal gut have different functions than distal gut. Some current techniques to treat obesity resect or exclude pylorus (Scopinaro's Bilio-pancreatic bypass, Fobbi or Capella Roux-in-Y Gastric Bypass). Biliopancreatic bypass, in the Scopinaro or Duodenal Switch mode, excludes the whole proximal gut and causes unspecific malabsorption that leads to nutritional deficiencies. Gastric Bypass excludes most of the stomach. Other techniques do not exclude, but just provoke sub occlusion, like Gastric Banding. The aggressiveness of these procedures impedes them from being used in the early progress of obesity.

In our point of view, the many digestive functions are precious even to the obese. However we admit that gastric capacity is bigger than necessary when modern diet is used. Even the intestines, probably, are too long for the modern diet¹⁵. Then, for early obesity, we propose a vertical gastric resection - in the same mode already extensively used in the "Duodenal Switch" technique ¹⁶, associated to omentectomy.

METHODS

Technique

A six centimeters incision is made 2 cm under the left costal margin, parallel to it, opening the abdominal cavity. A device developed to allow the introduction of the hand in the abdomen without losing the pneumoperitoneum (Lap Disk[®] - Ethicon Endo-Surgery, Inc.) is inserted. A trocar sleeve is put in the Lap Disk[®] and Lap Disk[®] is closed, allowing inputting gas and creating the 15 mm Hg pressure pneumoperitoneum, in a safe way. Under direct vision now, four other trocars are inserted (5mm in the epigastric region - for liver retraction; 12 mm in the right hypochondriac region for surgeon's left hand and for stapling; 5 mm in the left hypochondriac region, lateral to the Lap Disk[®] for an assistant; 5mm in the supra umbilical position to the 5mm camera). The gastric body and fundus are released from the greater omentum and short gastric vessels by section of with a harmonic scalpel (Ultracision® - Ethicon Endo-Surgery, Inc.). After, the gastroepiploic arcade is interrupted 6 cm proximal to the pylorus. Gastroepiploic vessels will remain intact in the antrum. A Fouchet tube is passed through the esophagus until the duodenum by the lesser curvature, with the help of surgeon's right hand through the Lap Disk[®]. A linear cutting stapler is used in order to resect gastric fundus and most of gastric body, leaving a gastric tube of 3 to 4 cm of diameter in the lesser curvature (Figure 1).



Figure 1: Scheme of gastric resection.

Gastric specimen is removed though the Lap Disk[®] which is the taken away (Figure 2). The great omentum is pulled out through the incision and detached from the transverse colon and removed as shown (Figure 3). Incisions are closed with intradermic running suture and covered with glue (Figure 4).

The Ethical Committee of the "Hospital da Policia Militar do Estado de São Paulo" approved the protocol. A detailed informed consent is signed by patients, which states that weight loss cannot be predicted because of lack of experience.



Figure 2: Stomach removed.



Figure 4: Final aspect.

First Patient and Early Result

RMR, male, 34, Weight 111 Kg, Height 174 cm, BMI: 36.6 Kg/m². He had been under many attempts of clinical treatment for ten years. By the time of surgical indication he was taking Orlistat. Sibutramine and others drugs had been taken before. He could not lose any weight and he began to present knee pain; no other comorbidity was

present but parents are diabetic and hypertensive.

Surgery took 120 minutes. He received cefazolin for 24 hours; he started taking liquids, in small portions, in 24 hours and was discharged in 48 hours.

He was oriented to take just liquids, not in more than 150ml at a time, for a week and then he



Figure 3: Epiploon resection.

was allowed to eat solids. There was a recommendation to start meals with a portion of salad. Fruits, vegetables, fish and chicken were recommended. He refers early satiety and he does not feel starving after more than 5 hours without eating like he used to. In the first seven days Omeprazole and metoclopramide were prescribed. No medication was prescribed after that. After 30 days, he lost 13 Kg, his BMI is now 32.3 Kg/m², and he is still losing weight. He is symptom free and very much satisfied. Eating a lot less now had consequences on his metabolic profile. Total cholesterol was 257 mg/dl and triglycerides, 212 mg/dl and 30 days after these results are respectively 189 mg/dl and 115 mg/dl.

DISCUSSION

The procedure may bring many advantages and we believe it can adapt the stomach to modern diet. Since food is now a lot more caloric than primitive diet, gastric capacity is reduced by more than 1 liter. However, there is no sub occlusion, no stenosis and no prosthesis. The stomach is proportionally reduced, but it keeps its general structure (cardia, body, antrum and pylorus). Innervation by the lesser curvature is intact. Satiety by gastric distension tends to occur with smaller volumes, because these volumes, in modern diet, are enough. When significant weight loss occurs, lack of elevation of Ghrelin production is expected because its major source is removed ^{4, 5}.

Omentectomy promotes resection of visceral fat, which is a source of PAI-1. It is believed that less visceral fat and less PAI-1 are related to a reduced risk of atherothrombosis ⁶. Omentectomy also provides a reduction in the source of Resistin and a source of free fat acids to the portal vein. Both events are thought to reduce hyperinsulinism and insulin resistance. As the specimens removed are bulky, the intra abdominal pressure (IAP) is reduced. High IAP is related to respiratory, hemodynamic and reflux problems.

This first early result is very stimulating not just because patient is losing weight without medication, surgical sub occlusions, neither malabsorption, but also because a new concept is involved. Surgeons, maybe for the first time, are working not to treat a diseased organ, but to adapt a healthy one to a new environment. The so-called "Evolutionary Surgery" protocol is ongoing at the Hospital da Policia Militar do Estado de São Paulo for nine months and other obese patients have been operated using the other steps in development. But just now, we operated on a patient that, strictly, would have no indication to a "Bariatric Surgery" because he was not sick enough (little comorbidties), nor fat enough (BMI less than 40 Kg/m²) to be operated on. However, this first step is simple, quite safe and it does not harm any digestive function, but it indeed may help the patient to not get any fatter or even to be more successful in his attempts to maintain an adequate weight.

We have to study the expected fall in ghrelin, resistin and PAI-1, as well as study many patients for long periods, to know exactly how helpful the procedure is. However, this simple surgical procedure is helping the patient to lose weight faster than any medication ever did. It helps him eat less with early and prolonged satiety, probably due to the removal of great deal of the ghrelin releasing cells. Eating less will probably impact cholesterol and triglycerides levels enhancing the benefit of removing PAI-1 and Resistin producing cells. Nonetheless, the improvement of metabolic profile will have to be observed with a significant number of patients, as well as long-term results.

The diminishment of acid production is thought to be an evolution too. Modern diet is almost sterile, when compared to the food in the animal condition. As this food also is easily digested, the acid production of the modern man is excessive, facing the kind of food man, himself, developed in the last half century. Indeed, excess of acid has been causing much more trouble than the lack of it and this may be expressed by the huge number of people taking acid reduction pills, the incidence of peptic complaints and gastroesophageal reflux.

Gastroesophageal reflux may be prevented by this procedure. First, because it reduces acid production. Second, because the tension in gastric fundus walls makes opposition to the lower esophageal sphincter (LES) action. As this tension is proportional to the gastric fundus diameter (Laplace's Law) and this was very much reduced, LES may get some extra efficacy. Indeed, there are no reports of problems of reflux after the Vertical (sleeve) Gastrectomy in the Duodenal Switch procedure. Nonetheless, is important to say that there (differently than here) they are protected against the alkaline reflux by the duodenal exclusion. However, there are no special reasons to suppose that alkaline reflux will be a problem here.

The current obesity surgical procedures are so aggressive that they cannot be recommended to patients prior to extreme obesity. So, by the time these procedures are performed, the patient has already damaged arteries and articulations, has already suffered the consequences of diabetes, hypertension, dyslipidemias, reflux and other obesity-associated conditions, besides the psychosocial problems. With these medical problems, the surgical risk is higher.

As the proposed procedure is simple and safe and as it maintains the general structure and important digestive functions unharmed, with no need of nutritional support, it can be recommended to patients before extreme obesity, which reduces even more the surgical risk (already low by the procedure itself). Extreme obesity is a severe condition, with some irreversible physical and psychological damage developed over years. Avoiding its development may be better than to treat it.

This may be a physiologically acceptable procedure not to treat extreme obesity but to prevent it, before its development is obvious or its associated diseases are evident.

In fact, this is an evolutionary and adaptive surgery that would not be necessary had we had kept our primitive diet. It might become a very important procedure since it can help stop the development of obesity, hypertriglyceridemia, hypercholesterolemia, type II diabetes, hypertension, atherothrombotic disease and other typical conditions of the XX and XXI Centuries.

CONCLUSION

This is the preliminary report of a procedure that is the association of two well-known procedures: Vertical Gastrectomy and Omentectomy. Both are very simple and safe. Together, they produce a proportionately reduced stomach, however without changing its general structure like other obesity surgeries do. No stenosis, no sub occlusions, no prosthesis, no excluded segments, no malabsorption, no blind endoscopic areas and, fundamentally, no harm to important digestive functions. The operated patient will not need nutritional support or chronically take pills because of the procedure. Removing the source of ghrelin and early satiety through distension may help weight loss. Weight loss and the removal of main sources of resistin and PAI-1 may contribute to a better metabolic profile.

The "evolutionary procedure" intends to adapt the stomach to modern diet and as it is simple and safe it may be used early in the treatment of obesity, possibly generating benefits in the treatment of diabetes and in the atherothrombosis risk.

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RESUMO

OBJETIVO: Esta é a comunicação preliminar de uma nova técnica cirúrgica para tratar e prevenir o avanço da obesidade: Gastro-Omentectomia Laparoscópica. O primeiro caso é relatado assim como as bases fisiológicas e evolucionárias para o procedimento. MÉTODO: A técnica inclui uma gastrectomia vertical por grampeamento e a omentectomia realizada por laparoscopia e auxiliada por equipamento que permite e uso auxiliar da mão sem a perda do pneumoperitônio. RESULTADOS: Um paciente com IMC 36 Kg/m² foi operado, teve alta em 48 horas sem queixas, perdeu, até agora, 13 quilogramas em 30 dias e refere saciedade mais precocemente. CONCLUSÕES: Este procedimento evita criar sub-estenoses, colocar próteses, excluir segmentos digestivos do trânsito de nutrientes, gerar malabsorção e fundamentalmente, evita prejudicar funções digestivas. O procedimento gera uma restrição moderada, o que colabora para a saciedade precoce por distensão gástrica com menores volumes e visa também modificar as circunstâncias neuroendócrinas, retirando grande parte da fonte produção de grelina, do Inibidor da ativação do plasminogênio-1 (PAI-1) e da resistina. O paciente operado não necessita suporte nutricional nem o uso crônico de medicações. O procedimento é simples, seguro, rápido, além de ser fácil de ser realizado.

Palavras-chave: OBESIDADE/cirurgia; OBESiDADE MÓRBIDA; OMENTO/cirurgia; GASTRECTOMIA/cirurgia; GASTROPLASTIA; grelina, humana; resistina; PAI-1; TECIDO ADIPOSO.

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