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CONTROL OF HYPERTENSION AFTER ROUX-EN-Y GASTRIC BYPASS AMONG OBESE DIABETIC PATIENTS

Everton **CAZZO**, Martinho Antonio **GESTIC**, Murillo Pimentel **UTRINI**, Ricardo Rossetto **MACHADO**, José Carlos **PAREJA** and Elinton Adami **CHAIM**

ABSTRACT - ***Context*** - Hypertension is a common disorder in general practice and has a widely known association with type 2 diabetes mellitus. Low adhesion to clinical treatment may lead to poor results. Obesity surgery can bring early and relevant resolution rates of both morbidities. ***Objective*** - To describe hypertension evolution after Roux-en-Y gastric bypass in patients with type 2 diabetes mellitus. ***Method*** - Descriptive observational study designed as a historical cohort of 90 subjects with hypertension and diabetes who underwent Roux-en-Y gastric bypass and were evaluated before and after surgery. ***Results*** - It was observed a hypertension resolution rate of 85.6% along with markedly decrease in anti-hypertensive usage. Mean resolution time was 3.2 months. Resolution was associated with homeostasis model assessment – insulin resistance, preoperative fasting insulin, anti-hypertensive usage, hypertension time, body mass index and percentage of weight loss. Resolution of hypertension was not statistically associated with diabetes remission within this sample. ***Conclusion*** - Roux-en-Y gastric bypass was a safe and effective therapeutic tool to achieve hypertension resolution in patients who also had diabetes mellitus.

HEADINGS – Hypertension. Diabetes Mellitus. Roux-en-Y anastomosis. Gastric bypass. Bariatric surgery. Obesity.

INTRODUCTION

Essential hypertension is a disorder commonly observed in general practice. Its association with type 2 diabetes mellitus (T2DM) is widely recognized and it was already reported that 40% to 80% of all diabetic patients may probably be hypertensive as well[3, 26]. As a result of impaired autonomic function and extensive organ damage, higher blood pressure variability, marked orthostatic responses and impaired nocturnal blood pressure reductions are common features in diabetic individuals[26]. It is postulated that there is a substantial interconnection between metabolic factors and hypertension, beyond what we comprehend at the moment[4, 20]. The underlying pathophysiology of this interplay is yet to be understood, however increasing evidence regarding this topic is emerging. Among nondiabetic hypertensive patients, poor blood pressure control is associated with two fold increased risk of diabetes[4, 20]. The benefits of reducing blood pressure in diabetic patients have been clearly shown by the results of the Hypertension Optimal Treatment[13] and United Kingdom Prospective Diabetes Study[30] studies among others[7, 8, 10, 14, 29]. Diabetic patients may require more intense treatment to achieve the same blood pressure levels as nondiabetic individuals[18]. Adhesion to long term nonpharmacological and drug treatments constitute a point of concern once there are reports showing consistently low rates of complete adherence to both, especially in poorly developed regions[30]. Surgery for morbid obesity has become a standard treatment option leading to markedly lower morbidity[22]. Global impact of surgery on long term mortality reduction has already been observed on obese patients with 40% reduction on all causes mortality, 56% on coronary heart disease, 92% on diabetes complications and 60% on any type of cancer[1]. Improvement of metabolic comorbidites is observed early after surgery and it is not completely comprehended[22, 23]. It is known that most bariatric procedures lead to increased level of gastrointestinal hormones called incretins that raise insulin sensitivity. This mechanism is probably reinforced by late weight loss[23].

This study aims to describe hypertension evolution after Roux-en-Y gastric bypass in patients with T2DM.

METHODS

This study is descriptive and longitudinal and designed as a retrospective cohort. It included obese

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Grupo de Cirurgia de Obesidade, Departamento de Cirurgia, Universidade de Campinas – UNICAMP, SP, Brasil.
Correspondence: Everton Cazzo. Rua Hermantino Coelho, 77 / 03-11, 13087-500 – Campinas, SP, Brasil. E-mail: notrevezzo@yahoo.com.br

subjects which had T2DM according to American Diabetes Association (ADA) criteria who were submitted to open Roux-en-Y gastric bypass (RYGB) at Hospital de Clinicas – Unicamp between 2000 and 2010. This study was submitted and approved by the local Research Ethics Committee. Surgery was indicated based on the National Institutes of Health Consensus Statement criteria[12]. Sample size estimation was performed through single proportion formula with 95% confidence interval[5]. Precision was set at 10% and the calculated sample size was 84. Exclusion criteria for this study were: individuals who had undergone other bariatric procedures after RYGB, whose postoperative follow-up time was less than 12 months, and who belonged to vulnerable groups (mentally ill, institutionalized or aged under 18 years old).

From 672 subjects who underwent RYGB, 90 who filled criteria for both T2DM as specified by American Diabetes Association[2] and hypertension according to Brazilian guidelines[25], and had been followed for at least 12 months were included. Main characteristics regarding demographics, presence of hypertension, and preoperative pharmacological treatments were assessed. Anti-hypertensive usage before and after surgery were evaluated. Comparisons were made between the periods immediately before and at least one year after surgery, in order to measure the impact of the procedure on resolution of T2DM and hypertension. Some biochemical characteristics were evaluated included fasting glucose, fasting insulin, hemoglobin A1c, homeostasis model assessment – insulin resistance (HOMA-IR) in order to identify correlations with hypertension resolution or improvement. Hypertension resolution was achieved through three non-consecutive measures below 130/85 mmHg[25]. T2DM resolution was achieved according to American Diabetes Association criteria (FG < 100 mg/dL and HbA1c ≤6,5%)[2].

Statistical Analysis

The baseline characteristics of patients are described and then compared with postoperative period. Data were examined for normality according to the Pearson's chi-squared test. For univariate analysis of categorical variables, chisquare and Fisher's exact tests were carried out. The McNemar test was used for comparison of proportions between the two periods. To identify possible factors associated to the studied outcomes it was used the multiple logistic regression analysis. The significance level adopted was 5% (*P*-value <0.05). For execution of analysis it was used Statistic Analysis System (SAS) software for Windows version 9.2.

RESULTS

Of 90 patients selected for study, 69 (76.7%) were female and 21 (23.3%) were male. The mean age at surgery was 46 (range, 22-64) years. The mean postoperative and follow-up time was 35.1 (range 12-120) months. Main subject characteristics at baseline are summarized on Table 1.

TABLE 1. Subject characteristics at baseline

Gender	
Male	23.3%
Female	76.7%
Age	46 ± 10.8 yrs
BMI	44.4 ± 8.9 (35-80.8) kg/m^2
Weight (kg)	102.9 ± 18.7 (72-180) kg
Postoperative follow-up	34.8 ± 25.7 months
Comorbidities	
Hypertension	100%
T2DM	100%
Dyslipidemia	87.8%
Pharmacological treatments	
Insulin	21.1%
Oral Hypoglycemiants	98.9%
Anti-lipids	76.7%
Anti-hypertensive	100%

Mean hospital stay was 4.2 } 0.3 days. Overall surgical morbidity was 11.1% and the main complications were wound infection (4,4%) and atelectasis (2.2%). There was no mortality.

Patients experienced a significant decrease of body mass index from 44.5 } 8.8 kg/m^2 to 31.7 } 7.9 kg/m^2 (P<0.001). Mean weight loss was 29.7 } 9.3 kg (P<0.0001). Percentage of excess weight loss after surgery was 71.5 } 27.7%. Preoperatively, 100% patients had hypertension. After surgery, there were 13 (14.4%) who still had hypertension, leading to a resolution rate of 85.6% (P<0.0001).

There was a markedly reduction on anti-hypertensive classes usage after surgery from 1.6 (range, 1-4) to 0.5 (range, 0-2) drug (P<0.0001). Among patients who did not achieve hypertension resolution it was observed significant reduction on number of anti-hypertensive classes usage, from 2.3 before to 1.3 after surgery (P = 0.001). Mean resolution time was 3.2 months (range, 1-12). According to multivariate analysis, the factors statistically associated to hypertension resolution were: HOMA – IR (P = 0.0482), postoperative body mass index (P = 0.0017), hypertension duration (P = 0.0321), preoperative fasting insulin (P = 0.0385), number of preoperative anti-hypertensive classes (P = 0.0072), number of postoperative antihypertensive classes (P = 0.0002) and percentage of excess weight loss (P = 0.0011). Table 2 shows resolution rates varied according to hypertension severity grade as classified by Brazil-

TABLE 2. Resolution of Hypertension according to preoperative severity grade

Severity grade	N (%)	Resolution (%)
I	34 (37.8)	34 (100)
II	40 (44.4)	33 (82.5)
III	16 (17.8)	10 (62.5)
Total	90 (100)	77 (85.6)

N: number of patients

ian guidelines[25]. Resolution rates stratified according to preoperative number of anti-hypertensive classes are shown on Table 3.

TABLE 3. Resolution of Hypertension according to number of preoperative anti-hypertensive classes

Anti-hypertensive classes	N (%)	Resolution (%)
1	28 (31.1)	28 (100)
2	36 (40)	35 (97.2)
3	17 (18.9)	11 (64.7)
4	9 (10)	3 (33.3)
Total	90 (100)	77 (85.6)

N: number of patients

Before surgery, all patients had T2DM. Postoperatively nine (10%) still had it. Its resolution rate was 90% (P<0.0001). Analyzing hypertension resolution along with diabetes it was observed that 77.8% experienced resolution of both disorders, 12.2% had only diabetes resolution, 7.8% had only hypertension resolution and 2.2% had none. The association between resolution of both comorbidities were not statistically significant (P = 0.6127).

DISCUSSION

There is clear evidence about the great benefits of RYGB on hypertension and T2DM, especially when compared to the effectiveness of clinical treatment[23, 24]. It is known that this operation brings this impact through a complex array of metabolic mechanisms which involve increased incretin secretion due to duodenal exclusion or early arrival of nutrients on ileum; weight loss; decreased hepatic uptake of lipids; and changes on adipocin profile[17, 23, 28].

This study showed a high hypertension resolution rate (85.6%) among previously diabetic patients. T2DM resolution was also high (90.6%) although both resolutions were not statistically linked. This may be caused by the multifactorial nature of both disorders and the intrincate pathways by which they are associated[3, 20, 26]. A metanalysis involving 136 studies and 22,094 patients made by Buchwald et al.[6] revealed an overall resolution of hypertension of 75.4%. In a review of 19 studies carried out by Maggard et al.[19] resolution rates varying from 25% to 75% were observed. According to most studies, hypertension control appears to be so linked to improvement on insulin sensitivity and proinflammatory state as to proper weight loss[11, 15, 16, 27]. Previous Brazilian reports have shown similar results[9, 21].

Among the factors statistically associated with hypertension resolution in this sample, there were some related to insulin sensitivity (HOMA-IR, preoperative fasting insulin), others to hypertension severity (anti-hypertensive usage, hypertension duration) and still others directly linked to ponderal status (body mass index, percentage of excess weight loss). This finding clearly reinforces the complex pathophysiology of hypertension and its mechanisms of resolution after RYGB.

CONCLUSION

There was an important impact of RYGB on hypertension evolution in diabetic patients, thus this operation may be considered a safe and effective therapeutic option within this group.

Cazzo E, Gestic MA, Utrini MP, Machado RR, Pareja JC, Chaim EA. Controle da hipertensão arterial após bypass gástrico em Y-de-Roux em obesos diabéticos. Arq Gastroenterol. 2014,51(1):21-4.

RESUMO – ***Contexto*** **-** A hipertensão arterial é uma patologia frequente na prática clínica e sua associação ao diabetes mellitus tipo 2 é amplamente conhecida. A baixa adesão ao tratamento clínico comumente leva a resultados precários. A cirurgia bariátrica é capaz de promover precocemente índices elevados de resolução de ambas as morbidades. ***Objetivo*** **-** Descrever a evolução da hipertensão arterial após o bypass gástrico em Y-de-Roux em indivíduos diabéticos. ***Metodos*** **-** Estudo descritivo observacional de coorte histórica envolvendo 90 indivíduos com hipertensão e diabetes que foram submetidos ao bypass gástrico em Y-de-Roux, avaliados antes e após o procedimento. ***Resultados*** **-** Foi observado índice de resolução da hipertensão de 85.6% associado a grande redução na utilização de anti-hipertensivos. O tempo médio de resolução foi de 3.2 meses. A resolução esteve associada ao modelo de avaliação homeostática (HOMA) – resistência insulínica, insulina basal pré-operatória, uso de anti-hipertensivos, tempo de hipertensão, índice de massa corpórea e percentual de perda do excesso de peso. A resolução da hipertensão não foi associada estatisticamente à remissão do diabetes na amostra estudada. ***Conclusão*** **-** O bypass gástrico em Y-de-Roux foi uma opção terapêutica segura e eficiente para levar à resolução da hipertensão em pacientes diabéticos.

DESCRITORES - Hipertensão. Diabetes Mellitus. Anastomose em Y-de-Roux. Derivação Gástrica. Cirurgia Bariátrica. Obesidade.

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