ABCDDV/881

ABCD Arq Bras Cir Dig
2012;25(4):263-268

Original Article

EFFECTS OF BARIATRIC SURGERY ON PELVIC FLOOR FUNCTION

Efeitos da cirurgia bariátrica na função do assoalho pélvico

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ABSTRACT - ***Background*** - Urinary incontinence is well documented as a comorbidity of obesity. Studies demonstrate improvement of incontinency after weight loss. However, the mechanisms are still not clear. ***Aim*** - To analyze the effects of bariatric surgery on pelvic floor function in women. ***Methods*** - Thirty women were invited to participate. They were waiting for bariatric surgery. Evaluations were done on pre-operative period and one year after surgery. It comprehended: body mass index, urinary incontinence prevalence, quality of life through the King's Health Questionnaire, quality of pelvic floor muscular contraction through the Oxford Modified Scale and perineometry. ***Results*** -Twenty four women were included in the study. The body mass index reduced from 46.96±5.77 kg/m2 at the pre-operatory assessment to 29.97±3.48 kg/m2 one year after surgery. The average excess weight loss was 70.77±13.26%. The prevalence of urinary incontinence reduced from 70.8% to 20.8%. The King's Health Questionnaire showed significant reduction of urinary incontinence impact on quality of life in seven domains. The Oxford Modified Scale showed increased degree of muscular contraction after surgery. Perioneometry showed increased measure of muscular contraction after surgery. The average of the three ordered contractions went from 21.32±12.80 sauers to 28.83±16.17 sauers. The peak of contraction increased from 29±14.49 sauers to 30.92±16.20 sauers. ***Conclusion*** - Massive weight loss due to bariatric surgery positively affects the function of the pelvic floor and quality of life on morbidly obese women.

HEADINGS – Obesity. Bariatric surgery. Urinary incontinence. Pelvic floor.

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Financial source: none
Conflicts of interest: none

Received for publication: 28/03/2012
Accepted for publication: 18/07/2012

RESUMO - ***Racional*** - A incontinência urinária é bem documentada como comorbidade da obesidade. Estudos demonstram resolução ou atenuação da incontinência após a perda de peso. Porém, os mecanismos pelos quais isso ocorre ainda não estão claros. ***Objetivo*** - Avaliar os efeitos da cirurgia bariátrica na função do assoalho pélvico em mulheres. ***Métodos*** - Foram avaliadas 30 mulheres que estavam em lista de espera para realizar a operação. Foi verificada a prevalência de incontinência urinária no pré e no pós-operatório e seu impacto na qualidade de vida através do King's Health Questionnaire. A qualidade da contração muscular do assoalho pélvico foi avaliada através da Escala de Oxford Modificada e da perineometria. ***Resultados*** - Vinte e quatro mulheres finalizaram o estudo. O índice de massa corporal passou de 46,96±5,77 kg/m2 no pré-operatório para 29,97±3,48 kg/m2 no pós-operatório, e a perda percentual do excesso de peso média foi de 70,77±13,26%. A prevalência de incontinência urinária passou de 70,8% no pré-operatório para 20,8% no pós-operatório. Após um ano da cirurgia bariátrica, houve redução do impacto da incontinência urinária na qualidade de vida em sete dos nove domínios avaliados no questionário. A mediana da Escala de Oxford Modificada aumentou de três no pré-operatório para quatro no pós-operatório. A perineometria apresentou aumento significativo na média das três contrações solicitadas, passou de 21,32±12,80 sauers para 28,83±16,17 sauers na comparação pré e pós-operatória. O pico de contração também aumentou significativamente no pós-operatório em relação ao pré-operatório, passou de 25,29±14,49 sauers para 30,92±16,20 sauers. ***Conclusão*** - A perda massiva de peso através da cirurgia bariátrica repercute positivamente na função do assoalho pélvico e na qualidade de vida das mulheres com obesidade mórbida.

DESCRITORES - Obesidade. Cirurgia Bariátrica. Incontinência urinária. Diafragma da pelve.

INTRODUCTION

Obesity is considered an important public health problem, both in developed and developing countries[29]. There are approximately 500 million obese adults worldwide and its prevalence is increasing[29]. At least 2.8 million adults die each year due to overweight and obesity[29]. The World Health Organization estimates that

65% of the world population lives in countries where obesity kills more people than weight deficit[29]. In Brazil, about half of the adult population were overweight in 2008-2009, of which approximately 30% were obese[12].

Obese people are at a higher risk for developing various comorbidities: type II diabetes, dyslipidemia, cardiovascular and cerebrovascular diseases, coagulation disorders, degenerative joint disease, some types of cancer, sleep apnea and urinary incontinence[4,20].

Women suffering from obesity are more likely to develop urinary incontinence, especially when related to stress[7,16,23]. Stress urinary incontinence is defined as the loss of a small amount of urine that occurs in times of increased intra-abdominal pressure, such as during the act of coughing, sneezing, weightlifting or running[5].Theoretically, obesity leads to chronic increase in intra-abdominal and intra-bladder pressure, which fatigues and weakens the pelvic floor muscles, facilitating urine leakage, especially in the situations mentioned[2,10,25].

Excess weight is a modifiable risk factor. It is believed that weight reduction may be an effective treatment for urinary incontinence[24]. In obese, studies show that after massive, surgically induced weight loss, there is resolution or alleviation of the symptoms of urinary incontinence[14,15,20,22,26,27].

Urinary incontinence usually leads to withdrawal from social interaction, psychosocial frustrations and early institutionalization.2 Therefore, its diagnosis and treatment are particularly important in women with morbid obesity, contributing to the improvement of quality of life[1,13,17,20,26,27].

The aim of this study is to analyze the effects of weight loss induced by bariatric surgery on pelvic floor function.

METHODS

Female patients on the waiting list for bariatric surgery at the Clinical Hospital of the Federal University of Paraná in Curitiba, Brazil, during the period from April 2009 to January 2011, participated in this study. Patients were approached and invited to participate in the project when performing outpatient treatment with the Multidisciplinary Care Team for Obesity Surgery. The study was approved by the Ethics Committee on Human Research of the Clinical Hospital of the Federal University of Paraná.

Inclusion criteria were as follows: body mass index ≥ 40 kg/m2, being older than 18 years old and signing an informed consent. Exclusion criteria were: having underwent a gynecological operation for less than a year, be in urogynecologic rehabilitation or have done physiotherapy to this end, previous diagnosis of chronic obstructive pulmonary disease, previous diagnosis of neurological disease with interference in urinary function and menopause.

The included patients were evaluated in two periods: preoperative and one year after bariatric surgery. Both evaluations included a clinical interview, application of the specific questionnaire for urinary incontinence when appropriate, and a physical examination. All stages of evaluation were performed by the same physiotherapist to provide greater test reliability.

Was first carried out a clinical interview, in which was collected from the volunteers their personal data, history of previous diseases, surgical and obstetric history, and any medications of continuous use. At this time the patients were asked about involuntary loss of urine. The complaints were evaluated using the King's Health Questionnaire which allows to specifically measure the impact of urinary incontinence on the quality of life of women. It has been translated and validated in Portuguese[8]. It is composed of 20 questions concerning the nine domains related to urinary incontinence. These were: general health, the impact of urinary incontinence, limitations in activities of daily living, physical limitations, social limitations, personal relationships, emotions, sleep/alertness and severity measures.

Later, a physical examination was performed. In this step was measured the weight and height to calculate the body mass index and percentage loss of excess weight. The body mass index was calculated according to the criteria of the World Health Organization[29], and the percentage loss of excess weight was calculated according to Deitel[6]. After that, was measured pelvic floor muscle strength by manual test. The patient was placed in supine position on the gurney, with abduction of the legs, hips and knees flexed. Bidigital vaginal examination was performed with gloves and lubricant gel. An initial contraction was performed with the purpose of guiding the correct form of muscle contraction, avoiding valsalva and hip adduction. Then was requested a maximum contraction of the pelvic floor muscles and annotated the scores according to the Oxford scale modified by Laycock[3,9], shown in Figure 1.

The pelvic floor function was also assessed by perineometry, previously considered a reproducible method of assessment[11,21]. Three maximal contractions were measured during the preoperative and three during the postoperative period, with intervals of 20 seconds between contractions to avoid fatigue. Thus was evaluated the contraction peaks and the ability to maintain them on the three measurements. A digital perineometer (Kroman) was used, which shows the degree of muscle contraction on a scale score of 0 to 100 (Sauer Scale).

A binomial test was used to assess the likelihood of urinary incontinence. For the questionnaire

DEGREE OF FORCE	MODIFIED OXFORD SCALE
0	Lack of muscle response
1	Flicker of non-sustained contraction
2	Presence of low intensity, but sustained, contraction
3	Moderate contraction, felt like an increase in intravaginal pressure, which compresses the fingers of the examiner with small cranial elevation of the vaginal wall
4	Satisfactory contraction, compressing the fingers of the examiner with elevation of the vaginal wall towards the pubic symphysis
5	Strong contraction, firm compression of the examiner's fingers with positive movement towards the pubic symphysis.

FIGURe 1 - Scale of pelvic floor muscle strength[3,9]

variables and to assess the Modified Oxford Scale, the Wilcoxon's nonparametric test was used. To analyze the data collected with the perineometer the Student's t test for paired sampes was used. Variables compared between subgroups were assessed by the nonparametric Kruskal-Wallis test. P values less than 0.05 were considered statistically significant.

RESULTS

Thirty women were evaluated in the preoperative period, but one of them was not eligible to undergo bariatric surgery according to the multidisciplinary team, two died and three did not follow the postoperative treatment, preventing the completion of data collection. The study included 24 patients with a mean age of 38.83 ± 7.86 years. The body mass index decreased from 46.96 ± 5.77 kg/m2 in the preoperative evaluation to 29.97 ± 3.48 kg/m2 in the postoperative assessment and the mean percentage loss of excess weight in one year was 70.77 ± 13.26%.

Preoperatively, 17 women (70.8%) had urinary incontinence, while postoperatively only five patients (20.8%) remained incontinent. This decrease was statistically significant (p <0.00 - Table 1).

In evaluating the score of the questionnaire, only the 17 women (70.8%) with preoperative urinary incontinence were included. There was significant reduction in the impact of symptoms after one year of the operation in the domains: general health (p <0.001), impact of urinary incontinence (p = 0.001), limitations in daily activities (p = 0.003), physical limitations (p = 0.002), social limitations (p = 0.005), emotional (p = 0.005) and severity measures (p <0.001). The exceptions were the domains: personal relationships (p = 0.068) and sleep/alertness (p = 0.180), which showed no impact on quality of life of most preoperative patients, and remained stable postoperatively. These results are shown in Table 2.

TABLE 1 - Probability of urinary incontinence before and after bariatric surgery

UI - Preoperative	UI - Postoperative		Total	p-value(*)
	No	Yes		
No	7	0	7	(p<0,001)
Yes	12	5	17	
Total	**19**	**5**	**24**	

(*) Binomial test, p <0.05; NOTE: UI = urinary incontinence

TABLE 2 - Comparison of scores from the King's Health Questionnaire pre and post-bariatric surgery

Domain	Period	N	Mean	Median	SD	p-value (*)
General health	Preoperative	17	61,76	75,00	20,00	<0,001
	Postoperative	17	16,18	25,00	15,16	
	Difference	17	-45,59	-50,00	22,07	
UI impact	Preoperative	17	56,86	33,33	28,30	0,001
	Postoperative	17	7,84	0,00	14,57	
	Difference	17	-49,02	-33,33	31,44	
Daily activities	Preoperative	17	32,35	16,67	33,58	0,003
	Postoperative	17	0,98	0,00	4,04	
	Difference	17	-31,37	-16,67	31,67	
Physical limitations	Preoperative	17	34,31	33,33	30,88	0,002
	Postoperative	17	0,98	0,00	4,04	
	Difference	17	-33,33	-33,33	30,05	
Social limitations	Preoperative	17	20,91	11,11	23,20	0,005
	Postoperative	17	0,00	0,00	0,00	
	Difference	17	-20,91	-11,11	23,20	
Personal relationships	Preoperative	15	13,33	0,00	24,56	0,068
	Postoperative	15	0,00	0,00	0,00	
	Difference	15	-13,33	0,00	24,56	
Emotions	Preoperative	17	32,03	22,22	36,62	0,005
	Postoperative	17	1,96	0,00	8,08	
	Difference	17	-30,07	-11,11	36,80	
Sleep/Alertness	Preoperative	17	9,80	0,00	28,30	0,180
	Postoperative	17	0,00	0,00	0,00	
	Difference	17	-9,80	0,00	28,30	
Severity measures	Preoperative	17	55,39	58,33	27,47	<0,001
	Postoperative	17	9,80	0,00	13,25	
	Difference	17	-45,59	-41,67	27,81	

(*) Nonparametric Wilcoxon test, p <0.05; NOTE: - UI = urinary incontinence. - Difference = postoperative result subtracted from the preoperative result

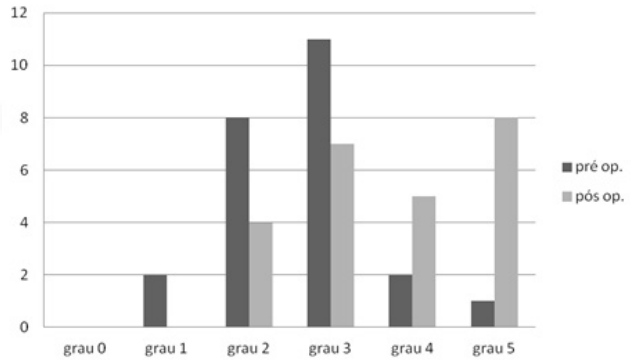
In the manual evaluation of the pelvic floor, the median of the scale of force at the preoperative period was equal to three, while the median at the postoperative period was equal to four. Thus it can be stated that the pelvic floor muscle strength, measured by the Modified Oxford Scale, was significantly increased one year after bariatric surgery compared to preoperative values (p <0.001). Table 3 shows the numbers obtained in the study.

TABLE 3 - Evaluation of pelvic floor muscle strength preoperatively and postoperatively according to the modified Oxford scale

Period	N	Mean	Median	Standard deviation	p-value(*)
Preoperative	24	2,7	3,0	0,9	
Postoperative	24	3,7	4,0	1,1	<0,001
Difference	24	1,0	1,0	0,8	

(*) Non-parametric Wilcoxon test, p <0.05

Four patients completed the study with grade two of pelvic floor muscle strength (16.7%), among them two had one degree improvements in strength (8.3%), one maintained the initial strength (4.2%) and one worsened by one degree (4.2%). Seven women completed the study with grade three (29.2%), six of which showed one degree improvement (25%) and one maintained the preoperative strength (4.2%). Five women finished with degree four of muscle strength (20.8%), among them, one increased by two degrees (4.2%), three increased one degree (12.5%) and one maintained the initial level of strength (4,2%). Eight women achieved grade five at the postoperative period (33.3%), six of them increased strength by two degrees (25%), one increase by one degree (4.2%), and one maintained preoperative muscle strength (4.2% - Figure 2).



NOTE: Pre op. = Preoperative; Post op. = Postoperative

FIGURE 2 - Distribution of patients according to the degree of pelvic floor muscle strength in the pre-and postoperative periods

In the assessment of pelvic floor through perineometry, we compared the mean of three contractions during the preoperative against the mean of three contractions at the postoperative period. The mean of the contractions significantly increased one year after surgery (p = 0.013 - Table 4).

TABLE 4 - Comparison of the mean of three contractions during the preoperative with the mean of three contractions at the postoperative period

Period	N	Mean	Standard deviation	p-value(*)
Preoperative	24	21,32	12,80	
Postoperative	24	28,83	16,17	0,013
Difference (post - pre)	24	7,51	13,70	

(*) Student's t-test for paired samples, p <0.05
NOTE: The difference (post-pre) = value obtained by subtracting the mean of the preoperative values from the mean of the postoperative values

Was also compared the mean peak contraction of the pelvic floor muscles achieved by women at the time of preoperative evaluation with the mean achieved one year after the operation. There was a statistically significant increase in mean peak contraction (p = 0.040 - Table 5).

TABLE 5 - Comparison of mean peak contraction in the pre- and postoperative periods

Period	N	Mean	Standard deviation	p-value(*)
Preoperative	24	25,29	14,49	
Postoperative	24	30,92	16,20	0,040
Difference (post - pre)	24	5,63	12,67	

(*) Student's t-test for paired samples, p <0.05
NOTE: The difference (post-pre) = value obtained by subtracting the mean of the preoperative values from the mean of the postoperative values.

Among the 24 participants, five women (20.8%) continued to have episodes of urinary incontinence after one year of operation, 12 (50%) had resolution of symptoms after massive weight loss, seven (29.2%) did not complain of urinary incontinence in the preoperative evaluation and continued the same way postoperatively. These three groups of women did not differ in age (p = 0.196) and percentage loss of excess weight (p = 0.460), whereas the number of births showed a significant difference (p = 0.018). Women who continued to have episodes of incontinence after surgery had more births compared with those who never had incontinence (p = 0.004) and also had more births compared to women who had resolution of the symptoms (p = 0.009).

When comparing the quality of pelvic floor muscle contraction pre-and postoperatively, there was significant increase in the group of women who had resolution of the symptoms both in the manual evaluation (p = 0.003) and in the evaluation performed with the perineometer (p = 0.021). Women who continued to have episodes of urinary incontinence after the operation showed no significant increase in the manual scale score (p = 0.109) and in the perineometry (p = 0.686), similarly, women who have never had urinary incontinence also showed no significant variation in the manual evaluation of the pelvic floor (p = 0.142) and perineometry (p = 0.345).

DISCUSSION

In this study, 17 of the 24 women who were waiting for bariatric surgery had urinary incontinence (70.8%). Likewise, many authors found a high prevalence of urinary incontinence among women with obesity[15,20,25,26].

From the observation that weight is a modifiable risk factor, studies began to expose the benefits of weight loss, including the resolution or mitigation of symptoms of urinary incontinence. Wing et al. concluded in their study that a weight loss of 5% to 10% of body weight can result in benefits for the obese and incontinent women.28 Taking into account that modest weight loss (5% to 10%) already brings benefits to women with obesity and incontinence, one may assume even more marked improvement owing to the

massive loss of weight by surgical means. In the present study, the probability of having urinary incontinence was significantly smaller after one year of bariatric surgery, so that only five (29.41%) of 17 women with urinary incontinence at baseline continued to show episodes postoperatively, i.e., 70.59% of resolution. In the group of Kuruba et al. the surgically induced weight loss improved or resolved urinary incontinence in 82% of patients treated14. A study of Whitcomb et al., among women initially with stress urinary incontinence, overactive bladder and anal incontinence, there was resolution of the symptoms within one year after the operation in 48%, 73% and 20% respectively[27]. Semins et al. concluded that patients undergoing bariatric surgery are more likely to healing and have less chance of developing urinary incontinence than those obese not surgically treated[22]. In the study of Laungani et al., 92% of women who underwent gastric bypass surgery by laparoscopy showed improvement in symptoms of urinary incontinence after one year of operation, with 64% of resolution[15]. In a literature review, Subak et al. concluded that weight loss is an effective treatment to alleviate the symptoms of urinary incontinence in obese patients[23]. Also in a literature review, Natarajan et al. concluded that there is preliminary evidence that weight loss in the long run might reduce the incidence and severity of urinary incontinence and various other urological problems[19].

In this study there was a significant decrease in the impact of urinary incontinence in seven of the nine domains addressed by the King's Health Questionnaire: general health, the impact of urinary incontinence, limitations in daily activities, physical limitations, social limitations, emotions and severity measures. The exceptions were the areas: personal relationships and sleep/alertness. The two domains that had no significant changes already had no major impact preoperatively and therefore suffered no great variation in the postoperative period. Auwad et al. also used the King's Health Questionnaire to evaluate 42 women with obesity and urinary incontinence, which achieved ≥ 5% loss of body weight in a weight reduction program. There was a significant decrease in the score, i.e., improvement in all nine domains that make up the questionnaire. 1 Several authors evaluated the influence of weight loss in urogynecological symptoms in obese women through specific interviews and obtained results that reinforce those found in this study, with improvements in symptoms of urinary incontinence and quality of life[15,17,20,26,27].

In this research, the pelvic floor muscle strength, measured by the modified Oxford scale, increased significantly one year after bariatric surgery compared to the preoperative period. Auwad et al. found similar results in their study group, patients who achieved weight loss ≥ 5% of body weight showed significant increase in pelvic floor muscle strength measured by the Oxford Scale, along with improvement in urinary leakage[1].

In this study, the quality of the muscle contraction of the pelvic floor through perineometry, as well as in the modified Oxford Scale, showed a significant increase in mean peak contraction of the pelvic floor postoperatively compared to the preoperative period. There was also a significant increase in the mean of the three contractions of the pre and postoperative periods, suggesting improvements in the ability to maintain peak contraction in three attempts. In the study group of Auwad et al. there was a non-significant, modest improvement in the strength of contraction of the pelvic floor evaluated by perineometer after modest weight loss[1]. Here in this study the outcome was different, but one must consider certain methodological differences such as the type of intervention for the weight loss and the resultant weight loss itself, which in this case was massive and surgically induced.

Few papers objectively assess the pelvic floor of obese women while they maintain excess weight and after massive weight loss induced by surgery.

In the present study it could not establish an association between the percentage loss of excess weight and the situation of postoperative incontinence. There was no significant difference in the percentage loss of excess weight when comparing women who have never had urinary incontinence, which had the resolution of the symptoms and women who continued to have urinary incontinence after surgery. Urinary incontinence appears to be a multifactorial condition in women with obesity. In the study of Laungani et al., the percentage loss of excess weight was not predictive of improved urinary incontinence at the 3rd and 12th months after gastric bypass laparoscopy[15]. Wassemberg et al. found no relationship between the scores of discomfort/impact of pelvic floor disorders and the percentage loss of excess weight in any of the domains assessed. In the study of Kuruba et al., as in the present study, the percentage loss of excess weight of patients who had persistent urinary incontinence did not differ significantly from the percentage loss of excess weight of patients who reported resolution or improvement of symptoms[14].

In this study, women who continued to have episodes of urinary incontinence after one year of operation had significantly more births compared with the group of women who had resolution of the symptoms of incontinence ($p = 0.009$). These results support the theory that urinary incontinence is multifactorial. El-Hefnawy et al. reported that women who have multiple births (≥ 3) have twice the risk of having severe urinary incontinence[7]. In the study of Masue et al., the body mass index and parturition had a positive and significant association with effort urinary incontinence[16]. The association of

two recognized independent risk factors for urinary incontinence probably result in greater severity of symptoms of incontinence and also make the treatment process more difficult.

This study group was younger, with a mean age of 38.83 ± 7.86 years. When analyzing the age, it did not differ between women who never had urinary incontinence and those that had the resolution of the symptoms or remained incontinent. This occurred because one of the exclusion criteria was menopause, precisely because of the recognized influence of estrogen deficiency on pelvic floor function[18].

For future studies, it can be suggested the inclusion of a control group of women with normal body mass index, or the inclusion of women who continue to show urinary incontinence in a urogynecologic rehabilitation group, and thus check for how to maximize the improvement achieved in the strength of contraction of the pelvic floor and obtain greater benefits in the continence mechanism.

CONCLUSION

The massive weight loss through bariatric surgery reflects positively on pelvic floor function and quality of life in women with morbid obesity.

ACKNOWLEDGEMENTS

Special thanks to the professionals of AMOC (Multidisciplinary Care Team for Obesity Surgery) who provided the space and helped us to get in contact with patients.

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