

Bariatric surgery improves pelvic floor disorders

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Abstract: Objective: To determine the frequency of pelvic floor disorders in patients with body mass index (BMI) greater than 30 Kg/m² and patients who underwent a bariatric surgery with a weight loss greater than 10% of their initial BMI. **Methods:** Self-administered questionnaires assessing pelvic floor disorders were applied. Statistical analysis was performed using Chi-square and ANOVA results to determine statistical significance. **Results:** 98 and 53 patients were included, with a mean age (SD) of 37.49 (10.65) and 38.95 (7.86) and average BMI of 42.957 (5.98) and 28.18 (5.86) for Obesity and PBS groups respectively. The analysis of questionnaires for Obesity and PBS groups demonstrated: ICIQ-SF (UI 50% - 30.9%) p = 0.022, Sandvik (SUI: Mild: 44.1% - 87% Moderate: 47.5% - 13%, Severe: 1.7% -0% Very Severe: 6.8% -0%) p = 0.00, B-SAQ ("symptom": 29.2% - 0%, "discomfort": 27% - 1.8%) p = 0.00, OAB-V8 (49.5% -14.8%) p = 0.00, Wexner (10.7% - 1.9%) p = 0.05, PISQ-12 (Female sexual response: 46% - 35.2%, Female sexual Limitation 12.6% - 13%, Male sexual Limitation 17.2% - 7.4%) p = 0.05, p = 0.00, p = 0.00 respectively. **Conclusion:** Our results confirm that the Obesity group reported more pelvic floor disorders such as UI, SUI, OAB, Severe Fecal Incontinence and Sexual Dysfunctions. The PBS patients with weight loss \geq 10% of initial BMI had less pelvic floor disorders. The overall FI including mild symptoms of fecal incontinence and flatus incontinence increased in the PBS group.

Keywords: Body Mass Index; Bariatric surgery; Urinary Incontinence; Fecal Incontinence; Overactive Bladder; Pelvic floor disorders; Obesity.

INTRODUCTION

Obesity is a health problem whose frequency is increasing globally in an accelerated way¹.

Pelvic floor disorders are also very common and comprise a spectrum of conditions such as UI, FI, sexual dysfunction and pelvic organ prolapse. These dysfunctions affect the quality of life of at least one third of women².

Obesity constitutes a major risk factor for pelvic floor pathology. Morbid obesity affects the pelvic floor³⁻⁴ with the presence of some degree of dysfunction in 90% of patients⁵. The prevalence of pelvic floor disorders increases with the degree of obesity⁶, so its presence produces a four-fold increase or twice or FI and UI, respectively⁷. Obesity is associated with higher rates of FI and diarrhea⁸ compared to the general population.

Pelvic floor pathology is a result of weakening of the supporting structures of the different pelvic organs⁹. These support structures should counteract the intra abdominal pressure for proper maintenance of continence and pelvic mechanisms functioning.

Overweight and obesity produce a progressive increase in intra-abdominal pressure which results in elevated hemi diaphragms and development of abdominal wall hernias and its recurrence, among other alterations¹⁰⁻¹². Obesity exerts a pressure increase chronically sustained in the pelvic floor¹²⁻¹³. Noblett et al. found a strong correlation between BMI, intra abdominal pressure and bladder pressure.

Thus overweight affects the continence mechanisms and operation of the pelvic floor^{3, 14-15} and increased abdominal pressure caused by increased BMI alters dynamic functional pelvic floor¹³.

The weight is a modifiable factor by surgical or nonsurgical approach. Weight control is effective for the management of pelvic floor dysfunction in obese patients¹⁶⁻¹⁷. Whitcomb and Subak demonstrated that obesity is a strong independent risk factor for the prevalence and incidence of UI. 5% increments on BMI leads to an increase of 20-70% of UI, on the other hand weight loss improves significantly the prevalence, frequency and UI symptoms¹⁸⁻¹⁹.

Bariatric surgery has gained more and more space in the treatment of obesity by decreasing concomitant dis-

eases such as cardiovascular risk, diabetes and osteoarthropathies. Bariatric surgery has also shown to have a positive effect on different pelvic floor dysfunctions²⁰⁻²². The influence of bariatric surgery in FI is unclear. Scozzari et al. described increased flatus incontinence in patients undergoing bariatric surgery²³ while Sileri et al. described decrease on defecation disorders in patients evaluated by the PBS Wexner Scale and the Scale of Severity of FI²⁴.

Currently, bariatric surgery is an effective treatment option for weight control in selected patients and could become the first choice of treatment for obese patients with associated pelvic floor disorders. It could reduce symptoms and prevent surgeries improving global conditions of the patient and where symptoms persist reduce surgical complications and relapses.

The aim of this study is to evaluate and compare the frequency of different symptoms of pelvic floor disorders in obese patients and patients who underwent bariatric surgery with a weight loss greater than 10% of initial BMI.

MATERIALS AND METHODS

This is a prospective and descriptive study. Self-assessment, pelvic floor symptoms tests were applied to study groups. Obesity group: patients with BMI > 30 Kg/m² who attend preoperative consultation for bariatric surgery, and PBS group: patients who underwent a bariatric surgery with a weight loss greater than 10% of their initial BMI. Both groups consisting of patients who attended Barosalud and Dr. Miguel Perez Carreño Hospital, Caracas – Venezuela Bariatric Surgery preoperative consult, between January 2015 and June 2016.

The inclusion criteria for obesity group were female patients with BMI > 30 Kg/m² with standard criteria for bariatric surgery and informed consent for the study. For the PBS group inclusion criteria were patients who underwent bariatric surgery with a weight loss of at least 10% of initial BMI.

The epidemiological data collected were Age and BMI in kg/m² (calculated as weight divided by the square of height).

The applied tests were International Consultation of Incontinence Questionnaire - Short Form (ICIQ-SF), Evaluation of SUI Sandvik, Self Assessment Bladder Control Questionnaire (B-SAQ), Evaluation Questionnaire of OAB (OAB-V8), Wexner Evaluation of Fecal Incontinence and the Pelvic organ prolapse / Urinary incontinence Sexual Questionnaire (PISQ-12).

The tests were analyzed for global scores and in some cases for different specific domains of each one.

ICIQ-SF: Geared for detecting UI consists of three questions (“frequency”, “quantity”, “affectation”), plus a group of 8 questions that are not part of the questionnaire score, and are descriptive and guiding on the type of UI²⁵. The total score is obtained from the sum of the points of the first three questions and ranges from 0-21 points. It is taken as UI presence any score greater than 0.

Sandvik Scale: This test assesses the severity of UI based on the frequency (4 options) and the amount of leakage (3 options). The value is obtained by multiplying both scores and is categorized into 4 levels: mild (1-2), moderate (3-6), severe⁸⁻⁹ and very severe^{12, 26}.

Self-Assessment Bladder Control Questionnaire (B-SAQ): This questionnaire was developed for patients with OAB who can identify this problem or for be used in medical consultation. It consists of 8 questions grouped in two scales (“discomfort” and “symptom”). The cutoff point was less than 6 points on the scale of “symptom” with a sensitivity of 84.8% and a specificity of 39.7% and a sensitivity of 81.8% and a specificity of 27% for the scale of “discomfort”²⁷.

OAB Questionnaire (OAB-V8): Allows diagnosis of probable OAB. It consists of 8 questions each with 6 possible answers with scores of 1 to 6. OAB is probable with scores greater than 8 points with sensitivity of 82.8% and specificity of 73.5%²⁸.

Wexner Scale: Evaluates 5 parameters including type of loss and impaired quality of life, on a scale from 0 to 4 according to the frequency of occurrence episodes of fecal incontinence. It is interpreted with the sum of each parameter being 0 perfect continence and 20 when there is complete incontinence. The cutoff point between mild and severe FI is the presence of 9 or more points²⁹.

PISQ-12: Evaluates sexual function in women with UI and / or pelvic organ prolapse. It consists of 12 questions measuring three parameters: a) female sexual response (1 to 4 and 12), female sexual limitation (5-9) and male sexual or partner limitation (10-11). The answers are assigned on a scale from 0-4 points ranging from “never” to “always”. Obtaining 0 or 1 point in any of the questions of the evaluated parameters is suggestive of dysfunction in the evaluated domain³⁰.

STATISTIC ANALYSIS

The mean and standard deviation of continuous variables were calculated. In the case of nominal variables, it frequencies and percentages were calculated. BMI contrast compared to the analyzed variables was assessed with the chi-square test.

For hypothesis testing in this research it was considered significant a value of $p < 0.05$. SPSS 22 for the application data analysis was used.

Finally tests analysis of variance (ANOVA) was performed to determine the actual effect of bariatric surgery (improvement or deterioration) and direct influence on symptoms evidenced and evaluated in the test described above. The analysis of variance p-value was 0.05.

RESULTS

Numbers, age and BMI.

98 Patients were included in the obesity group with an average age of 37.49 years (range of 15.93 to 65.03), mean BMI 42.95 kg / m² (range from 31.48 to 62.5). 53 patients were included in the PBS group with a mean age of 38.95 years (range 24.03 to 54.82), BMI average of 28,185 kg / m² (range from 20.96 to 45.77) (Table 1). For age the Chi-square test resulted in a p-value of 0.41 with a significance level of 5%. The test of independence of the variable BMI resulted in a p-value of 0.10.

ICIQ-SF

The analysis of this questionnaire in obese patients showed presence of UI in 50.0% and absence of UI in 50.0%, while in the PBS group 30.9% reported UI and 69.1% did not refer UI symptoms (Graphic 1).

Chi-square analysis showed a p-value of 0.022. Contrasting it with a significance level of 5%, we can say that overweight and bariatric surgery significantly influence UI (Table 2). The result of p-value in the ANOVA for the variable UI was 0,022.

Sandvik scale

In Obesity group the following percentage was obtained according to severity: 44.1% had mild UI, 47.5% moderate, 1.7% severe and 6.8% very severe.

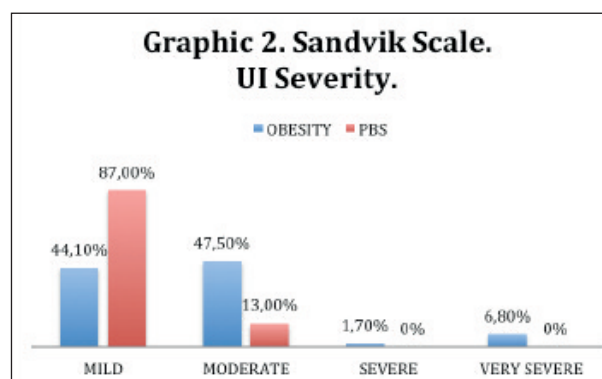
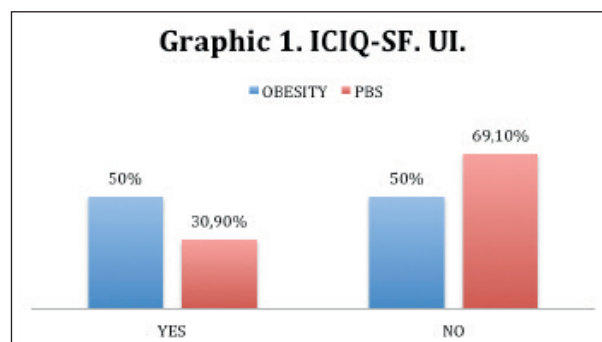


TABLE 1. Main characteristics of the two groups of women included in the study.

	Obesity			PBS		
	N	Mean	SD	N	Mean	SD
Age	98	37.49	10.65	53	38.95	7.86
BMI	99	42.957	5,98	32	28,185	5.86

N number, BMI body mass index, SD Standard Deviation

TABLE 2. Relationship between Questionnaires and State.

	DOMAIN		STATE		TOTAL	P value
			OBESITY	PBS		
ICIQ-SF	IU	Yes	49	8	57	p = 0.022
		No	50	46	96	
	Total			99	54	153
SANDVIK SCALE	Mild		26	47	73	p = 0.00
	Moderate		28	7	35	
	Severe		1	0	1	
	Very severe		4	0	4	S
	Total		59	54	113	
B-SAQ	Symptom	Yes	26	0	26	p = 0.00
		No	63	55	118	
	Total		89	55	144	S
	Discomfort	Yes	24	1	25	p = 0.00
		No	65	54	119	
	Total		89	55	144	S
OAB-V8	OAB	Yes	49	8	57	p = 0.00
		No	50	46	96	
	Total		99	54	153	S
WEXNER SCALE	SFI	Yes	9	1	10	p = 0.05
		No	75	53	128	
	Total		84	54	138	S
	Mild FI	Yes	30	39	69	p = 0.00
		No	54	15	69	
	Total		84	54	138	S
	Flatus incontinence	Yes	29	39	68	p = 0.00
		No	55	15	70	
	Total		84	54	138	S
	Liquid incontinence	Yes	11	11	22	p = 0.255
		No	73	43	116	
	Total		84	54	138	NS
	Solid incontinence	Yes	6	3	9	p = 0.712
		No	78	51	129	
	Total		84	54	138	NS
	Using diapers	Yes	14	1	15	p = 0.006
		No	70	53	123	
	Total		84	54	138	S
	Quality of life	Yes	12	12	24	p = 0.230
		No	72	42	114	
Total		84	54	138	NS	
Only flatus incontinence	Yes	7	18	25	p = 0.208	
	No	47	66	113		
Total		54	84	138	NS	
PISQ-12	Disf Female Sexual Response	Yes	40	19	59	p < 0.05
		No	47	35	82	
	Total		87	54	141	S
	Disf Female Sexual Limitation	Yes	11	7	18	p = 0.00
		No	76	47	123	
	Total		87	54	141	S
Disf Male Sexual Limitation	Yes	15	4	19	p = 0.00	
	No	72	50	122		
Total		87	54	141	S	

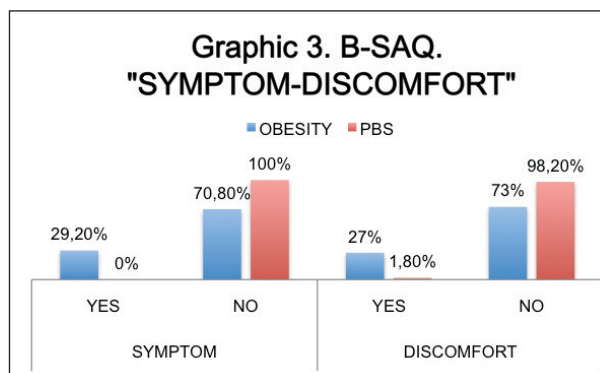
Significance level 5%, S significant, NS not significant

In PBS group we observed 87% mild UI, 13% moderate, 0% severe and 0% very severe (Graphic 2).

The analysis showed a statistically significant difference (p = 0.00), the p-value indicates that there is a relationship between the state variables (obesity and PBS) and presentation of UI (Table 2). The analysis of variance shows that the variable severity has a p-value of 0.00.

Self-assessment bladder control questionnaire (B-SAQ)

In Obesity group 29.2% had “symptom” and 27% “discomfort”; and in PBS 0% had “symptom” and 1.8% “discomfort” (Graphic 3).



The Chi-square statistical analysis showed a statistically significant difference for “symptom” (p = 0.00) and “discomfort” (p = 0.00), this means that there is a relationship of dependency between before and after bariatric surgery in the domains of “symptom” and perceived “discomfort”.

The analysis of variance yields p-value of the variable “discomfort” and “symptom” of 0.351 and 0.00 respectively (Table 2).

OAB questionnaire (OAB-V8)

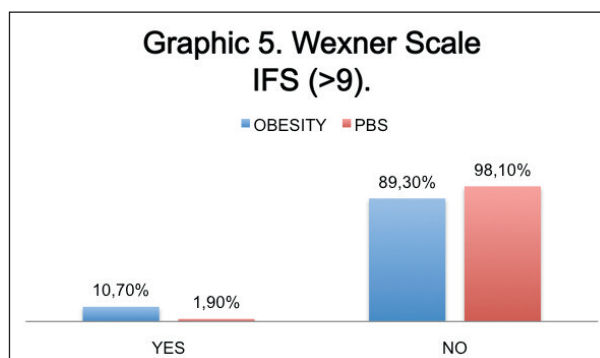
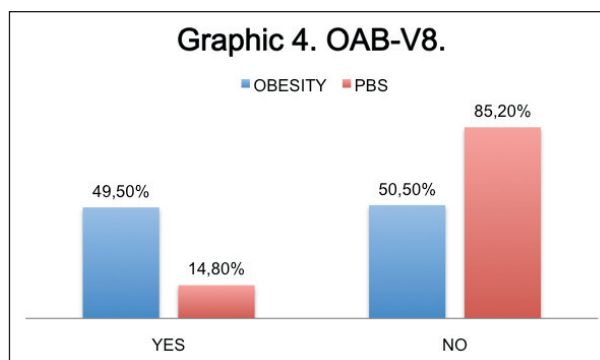
OAB questionnaire was applied on both groups obtaining the following percentages: Obesity group presented 49.5% OAB, while the PBS group presented 14.8% (Graphic 4). The obtained p-value of 0.00 reveals that obesity and bariatric surgery significantly influence the variable OAB (Table 2).

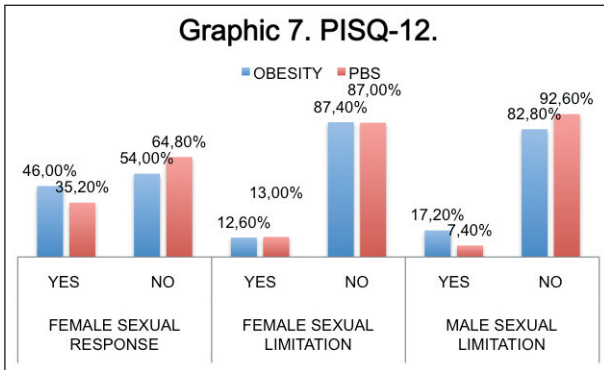
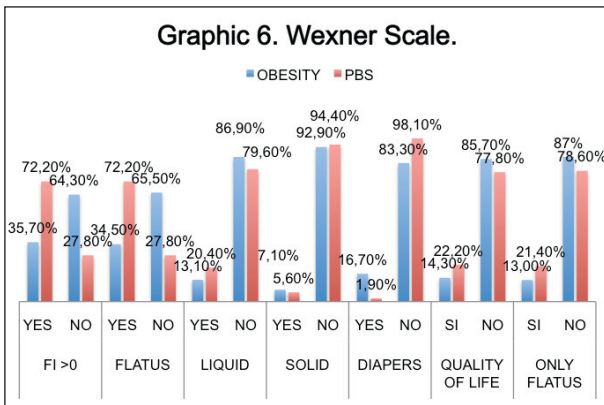
The ANOVA yields a p-value of 0.000 for the results of the OAB questionnaire.

Wexner scale

The Obesity group presented SFI in 10.7% of patients, while in the PBS group was observed in 1.9% of patients (Graphic 5).

Statistical analysis showed a p-value of 0.05 (Table 2), so the state variables (Obesity and PBS) are independent of the presence of SFI according to Wexner Scale. However,





being 0.05 so close to the rejection region we proceeded to apply the chi-square analysis for each of the items that build the Wexner scale, in order to evaluate which of these items were significant and which were not.

In Graphic 6, it is observed that PBS group has higher rates of overall FI interpreted as greater than 0 (72.2%), flatus incontinence (72.2%), liquid stool incontinence scores (20.4 %), impaired quality of life (22.2%) and higher frequency of flatus incontinence exclusively (21.4%) than Obesity group.

Statistical analysis of the presence of FI as scores grater than 0 result in a p-value of 0.00, the state variables Obesity and PBS are related to the FI evaluated in all domains of Wexner Scale.

The assessment of the Incontinence to flatus yielded a p-value of 0.00, bariatric surgery statistically impacts on incontinence to flatus.

The statistical analysis of incontinence to liquid or solid stool yielded a p-value of 0.255 and 0.712 respectively with a significance level of 5% therefore the fact of presenting incontinence to liquid stool or solid is not influenced statistically by bariatric surgery.

The domain Using Diaper showed a p-value of 0.006, bariatric surgery affects Diaper reducing the use of diapers in patients with FI.

Square chi test in the domain of affection of Quality of Life on Wexner Scale test yields a p-value of 0.230, the variables are independent, bariatric surgery did not affect the quality of life of patients with FI.

The ANOVA reveals that the p-value of the FI variables, flatus and use of diapers is 0,000; other domains presented at the Wexner Scale showed p-values greater than 0.05.

There was a strong correlation between the variables liquid stool, solid stool and continence to flatus with variable quality of life. Patients feel that having symptoms of incontinence to liquid stools and incontinence of flatus reduces their quality of life much more than the other domains listed in the Wexner test.

TABLE 3. Relationship between dysfunction and used questionnaire.

UI	ICIQ-UI SF	Bariatric surgery influence with statistically significance improving UI
SUI	Sandvik	Bariatric surgery influence with statistically significance improving SUI
OAB	Self-assessment questionnaire on Bladder control (B - SAQ)	Bariatric surgery influence with statistically significance improving "symptom", while for the domain of "discomfort» there was no statistically significant influence.
	Questionnaire OAB (OAB - V8)	Bariatric surgery influence with statistically significance improving OAB
FI	FI Wexner Scale (Wexner)	Bariatric surgery influence with statistically significance reducing SFI and the use of diapers, and increase global FI, predominantly FI to flatus.
Sexual Dysfunction	PISQ 12	Bariatric surgery influence with statistically significance but has not direct impact improving sexual dysfunction domains such as response or limitation.

PISQ-12

In the Obesity group domains Female Sexual Response, Female Sexual Limitation and Male Sexual Limitation reported 46.0%, 12.6% and 17.2% respectively, while in the PBS group showed 35.2 %, 13.0% and 7.4% for Female Sexual Response, Female Sexual Limitation and Male Sexual Limitation (Graphic 7).

A Chi-square analysis demonstrated that bariatric surgery is related to female sexual response since the p-value is less than 0.05 (Table 2).

The evaluation of Female Sexual Limitation reflects a p-value of 0.00, so bariatric surgery affects the female sexual limitation.

By analyzing the domain Male Sexual Limitation with a significance level of 5%, the null hypothesis is rejected because the chi-square statistic shows a p-value of 0.00. This represents that bariatric surgery is related to male sexual limitation.

The general p-value shown by ANOVA was 0.529.

DISCUSSION

Pelvic floor disorders are the product of weakening and dysfunction of ligamentous muscle support structure,

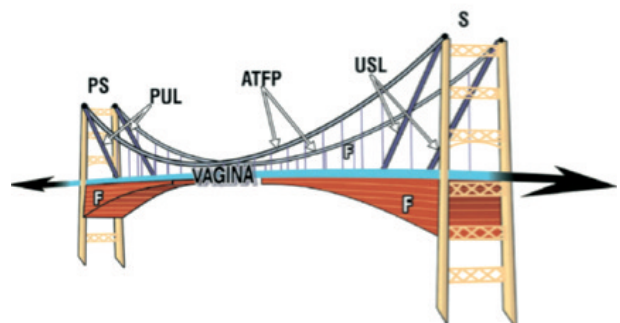


Figure 1. – Pelvic Floor Structure. Suspension bridge analogy. It represents that pelvic floor structures are interdependent. In a suspension bridge force it is maintained through the tension of the steel lines (arrows). The weakening of any part of the structure can alter the balance, strength and overall function. PS pubis, PUL Pubourethral Ligament, ATFP Tendinous arch of Endopelvic fascia, USL uterus sacral ligament, S sacrum. By permission, PE Petros.

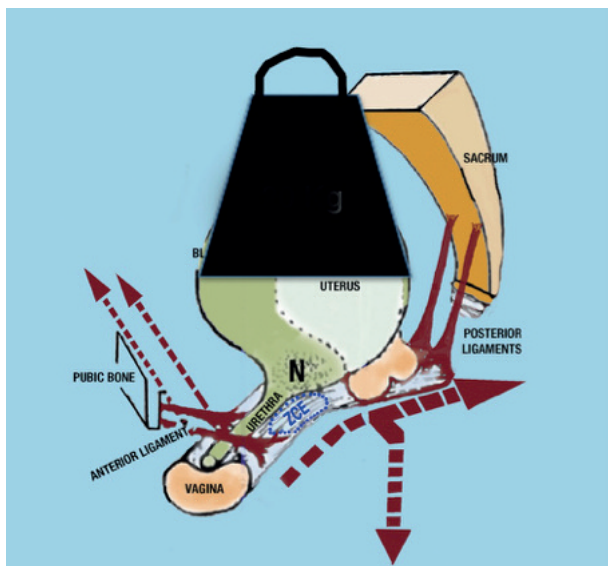


Figure 2. – Pelvic Floor with chronic overload pressure by high BMI. Modified by Piñango. By permission, PE Petros

which forms the lower end of the abdominal cavity (Figure 1)⁹ and through which urinary system, the digestive system and the female genital organs communicate with the exterior. Thus we believe that the increase of intra-abdominal pressure affects the overall function of the pelvic floor whose symptoms include UI, FI and sexual dysfunction.

Increasing the intra-abdominal pressure chronically product of obesity, also increases the pressure on the support structure of the pelvic floor¹³ causing suboptimal performance in the mechanisms of continence and the overall activity of the pelvic floor (Figure 2).

The additional load on the anterior wall of the vagina requires additional muscle strength to close the urethra, tighten the vaginal membrane receptors to support the “N” and then prevent activation of the micturition reflex (Urge incontinence).

We demonstrated that the UI, SUI, OAB, Several Fecal Incontinence and use of diapers showed a statistically significant improvement in direct relation to the weight reduction after bariatric surgery.

UI assessment according to ICIQ-SF showed the direct impact of surgery on the decline in the presentation of the UI. These results are consistent with the published literature where weight loss is considered an effective conservative approach for reducing symptoms^{21, 31}.

The evaluation of SUI with Sandvik Scale reflects a shift of patients in the categories of severe incontinence and very severe to mild to moderate levels. The analysis of variance showed the effectiveness of bariatric surgery to reduce the severity of UI in the post-bariatric group²⁰.

The evaluation of the OAB showed statistical difference direct impact of bariatric surgery in reducing the OAB, which coincide with the published literature^{19, 32}.

FI analysis showed decreased frequency of SFI in PBS group and increase of low severity FI and flatus incontinence. The findings in the literature yield controversial results^{20, 23-24}. The SFI with scores ≥ 9 points decreased statistically significantly in the PBS group although ANOVA analysis showed no direct influence leading to the conclusion that although there was a statistically significant decrease by Chi-square, this may not necessarily be a direct result of surgery per se, as there are other potential variables (intestinal malabsorption, dietary changes, etc.) that can be added and also affect continence in PBS patients.

The assessment of sexual dysfunctions through the PISQ-12 instrument showed that bariatric surgery affects with statistical significance decreasing symptoms (according Chi-square) but it does not occur as a direct relation to the PBS state. These data are consistent with Oliveira et al who showed improvement in sexual function in relation to the impact on urinary incontinence²⁰. There are other factors that must be evaluated in the PBS patients such as increased self-esteem, physical conditions and the interrelation with the couple that could influence more importantly, directly, in improving sexual function³³⁻³⁵.

We can conclude that loss of at least 10% of initial BMI post bariatric surgery results in significant decrease of symptoms including UI, SUI, OAB, SFI and Sexual Dysfunctions. Clinical improvement in sexual dysfunction is not produced directly by bariatric surgery (Table 3).

There are changes in gastrointestinal function on PBS group that make both groups different in their characteristics with major episodes of flatulence and diarrhea in the PBS group probably consequence of alterations of gastrointestinal tract and malabsorption associated with surgery. To measure the impact of weight loss in voiding function continence study groups should have similar characteristics in gastrointestinal functioning.

DISCLOSURES

Authorship: Piñango-Luna SM. participated in the initial research design, data collection and data analysis, manuscript drafting and final approval; Level-Cordova LR. participated in the initial research design, data collection, manuscript drafting and final approval; Márquez M. participated in the initial research design, data collection; Chaves L. participated in the initial research design, data collection. Delgadillo J. Statistician: jorge.estadistica14@gmail.com.

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