# 33 - EVALUATION OF BREATHING MECHANICS DURING BARIATRIC PRE-SURGERY OF MODERATE AND MORBID OBESE

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**INTRODUCTION:**

Obesity is considered as excessive accumulation of body fat. It may lead to risk to health, having been fat percentuals above normal, which would imply numbers higher than 20% in males and 27% in females. It may have endocrinological, genetic, socioeconomical, environmental, cultural, psychosocial and other factors as origin (BOTELHO et al., 2000).

Among other organic mal-functions, obesity has been attributed responsible for the growth of mortality and morbidity, leading to a deterioration in the quality of life. Sedentarism due to the advancement of technology and other factors such as alcohol consumption, smoking and stress, has lead to the growth of obeses indices in this country. It becomes evident the prevalence for obesity within Brazilian population., where 32% of this population presents a degree of over-weight (BENÍCIO et al., 2004).

In accordance with criteria of body weight, individuals suffering from morbid obesity present growth of 100% above ideal weight or 45-50 kg in excess in relation to ideal weight. Usually, men weighing more than 120-130 kg and women above 100-110 kg. In a broader definition, individuals obligatorily present serious co-morbitiy directly related to obesity, such as: mechanical arthropathy, Type II diabetes, arterial hipertension, dislipidemy, cardiopathy and sleep apneia among others (ZILBERTEIN et al., 2002).

There exist various surgical procedures for the treatment of obesity, so-called bariatric surgeries, also popularly known as "surgery for stomach reduction based on different physiotherapeudical concepts. Amongst the most often used these days we may cite the restrictive and bypass surgeries (GARRIDO JR. et al., 2002).

Bariatric surgery must be done in morbid obese patients who were not able to succeed in other therapeudic measures such as diet therapy, physical exercise, behavioral therapy, pharmacologic treatment (HALPERN; MANCINI, 2002).

The main pulmonary alterations caused by the surgery are related to the decline of vital capacity (VC) and functional residual capacity (FRC). Within the first 16 to 24 hours after surgery there is a reduction around 50 to 60% of vital capacity and 30% decrease of functional residual capacity. Pre-surgery's pulmonary physiotherapy has been practized envisaging the prevention or minimization of complications' occurence and evolution, through techniques of pulmonary expansion and brochial higene (SAAD; ZAMBOM, 2001).

Due to the increase of fat deposits within toraxic and abdominal cavities, there might occur progressive alterations in pulmonary function, being the most relevant the reduction of functional residual capacity (FRC). Among morbid obese, such deposits are found further below by a simple mechanical process of compression of the toraxic cavity and by the anatomical declines resulted from covering adipose mass (COSTA et al., 2003).

Obesity lowers the efficiency of breathing muscles, where muscular strength and endurance of these muscles may be reduced and damaged, aside from diaphragm movements, when compared to those individuals not obese. This happens because of the inspiratory overload, that increases oxigen consumption, breathing tasks and energy wasted breathing (PAISANI et al., 2005).

The present study proposes an evaluation of respiratory mechanics through muscular strength (Maximum Inspiratory Pressure - Max IP and Maximum Expiratory Pressure - Max EP) and forced vital capacity (FVC) in moderate and morbid obese patients, before and after incentive inspirometry during bariatric pre-surgery.

**MATERIALS AND METHODS**

Eleven patients were evaluated being diagnosed moderate and morbid obese, in association or not with co-morbidities, all of whom were to submit to bariatric surgery at Natal's Surgery Unit (UNICAD), from February 15 to May 23, 2006).

The sample was selected intentionally, constituting eleven patients, suffering from obesity, of both sexes, aged 19 to 55, interned at UNICAD. The inclusion factor was patients with CMI between 34.96 to 50.95 kg/m2, associated or not with co-morbidity, after unsuccessful attempts in other clinic treatments. The patients also needed surgery prescribed and cognitive capacity for understanding the free and consicous consent term. Patients with CMI below 34.96 kg/m2 were turned down, and those bearing psychological and respiratory problems.

A protocol for physiotherapeutical evaluation was used for the research's development, based on UNICAD's protocol, composed data from socio-demographic, clinic (anamnese and physical checkup), respiratory exercises, control record and guidance through respiratory exercises standards. The respiratory evaluation was composed of maximum inspiratory pressure Max IP, maximum expiratory pressure (Max EP), through a manovacuuometer branded GerAr (Braz. Ind.), with calibration of +300 cmH20 to -300 cmH20, forced vital capacity (FVC) through a ventilometer branded Ferraris Mark 8, with calibration of 100 liters.

The evaluation's procedures took place for seated position and in the following manner: Filling out the form for evaluation and respiratory function measures. Measurement of Max IP and Max EP, through do manovacuuometer, with calibration from -300 cmH20 for Max IP and +300 cmH20 for Max EP, placement of a nasal clip, the manovacuuometer was put into the patient's mouth with a mouthpiece. Max IP measurement was held through RV, followed by a manouver for forced inspiration with the mouth tied to the manovacuuometer's mouthpiece, up to the inspiratory reserve's volume, three times over and registering the peaks in cmH20. For Max EP measurement was held by inspiration up to inspiratory reserve's volume, followed by expiration up to residual volume RV. That was also repeated thrice and logged through the Ventilometer with 100 liters calibration. A nasal clip was placed, we solicited that the patient expired until the residual capacity out of the mouthpiece, and then he would follow a forced inspiration until the inspiratory reserve's volume with his mouth attached to the ventilometro's mouthpiece, three times and logged for the main liter part. All the measurements took place three times, most of which were registered.

Respiratory guidance was prescribed while at home five days before surgery. The guidance was explained to the patients in a demonstrative form utilizing the inspirometer of incentive. After that the physiotherapist prescribed after a series of 10 repetitions with the respiratory motivator., varying from R0 to R1, increasing in the following days. The patients were oriented to do 90 exercise sessions a day with the motivator, 30 in the morning, afternoon and evening. The exercises in each day's period must be done in three series of 10 repetitions, or, 30 divided in 3 of 10 repetitions. In accordance with the therapist's guidance teh resistance of the respiratory motivator should only be increased in case the patient would successufully perform the previous series. The patient must then fill in the control log after every session.

The control form and respiratory guidance were turned in on the day of surgery, properly filled out, where the patients were able to do the exercises. The patients were revaluated hours before surgery of the same inicial form. A "test t - Student" was used for interference statistics, tuned in for checking the differences among average value before and after the use of respiron from the analysed group, Microsoft Excel, version 2000 and Statistica 99 (a statistics software), and MS Word 2000, used for making the stat report.

**RESULTS AND DISCUSSION**

After data gathering we found the following results: Of all the eleven patients it was noted that 3(27.27%) were male and 8(72.73%) female. A average (±PD) age of the patients was 39.5(±6.8) years. In relation to CMI, the patients were classified as moderate obese and morbid obese, where 63.64% were considered moderate and 36.36% moderate. It was also noted the presence of co-morbities at 54.55% of the patients, being tireoideopathies (14.29%), resistance to insulin (28.57%), systemic arterial hipertension (42.86%), diabetes (14,29%).

**Table 1: Averages (PD) of Maximum Inspiratory Pressure (Max IP), Maximum Expiratory Pressure (Max EP) and Forced Vital Capacity (FVC) before and after respiratory motivator**

| *Variable* | *Pre-Respiratory Motivator (±PD)* | *Post-Respiratory Motivator (±PD)* | *p-value* |
|---|---|---|---|
| MaxIP | 99.09 (±37.27) | 120.45 (± 43.50) | 0.048 * |
| MaxEP | 130.81(±36.46) | 149.09 (± 39.86) | 0.187 |
| FVC | 3.25 (±0.93) | 3.45 (± 1) | 0.0009 * |
| * **p < 0.05** | | | |

On Table 1, we found teh average values (±PD) of the variables Max IP (Maximum inpiratory pressure), Max EP (Maximum Expiratory Pressure) and Forced Vital Capacity (FVC) before and after respiratory motivator. It has been observed a substantial improvement of respiratory muscular strength and forced vital capacity, however with statistically significant improvement for the Max IP and CVF variables.

Pinheiro et al. (2004) in his studies report that the adult population have been showing prevalence in excessive weight. According to the most recent data from PNSN (Pesquisa Nacional de Saúde e Nutrição) [National Research for Health and Nutrition], around 32% of Brazilian adult individuals present some degree of excessive weight, being from those 8% obese, with a higher percentage among women (70%), which has also been shown in our studies. They also add that in another study the rate of obesity are found to be 10.2 in males and 14.7% in females within the Brazilian population. Other authors like Abrantes et al. (2003) point out in their studies involving the Northeast and Southeast Brazilian regions that obesity maintains itself practically stable among men aged 30-59, decreasing after that age. Among women there is a progressive growth in the prevalence of obesity after the 70 years of age and afterwards they tend to drop.

Segal and Fandiño (2002) classify obesity in terms of seriousness, defining degree I when CMI is between 30 and 34 kg/m2, degree II when CMI is between 35 and 39.9% and degree III when CMI surpasses 40 kg/m2. Both the patients presenting CMI > 40 kg/m2 and CMI > 35 kg/m2 associated with some type of morbidity were candidates for the treatment.

Pinheiro et al. (2004) observe that obesity is responsible for the spread of health risking diseases, such as respiratory failure, dermatological alterations and disturbances in the locomotion system. Besides, it stimulates the existence of more serious infermities like dislipidemy, cardiovascular deseases, diabetes and cancer. However, excessive fat, its distribution along the organism and its consequences to health vary among the obese.

Marini (2004) explains that the respiratory motivators were respiratory exercisers that draw their fundaments in offering a resistance (load) to the patients' breathing, this way promoting teh strengthening of the respiratory muscles.

Azeredo (2000) in his serial measuring studies of maximum inspiratory pressure (Max IP), before and aafter therapeudics by inspirometry of incentive, has observed a growth in inspiratory muscular strength of more or less 8% in one week's training. Although it did occur an increase in Max EP variables were not meaningful. It has not been found in literature a co-relation between Max EP and the use of incentive inspirometry. Besides that the author reports that the technique of inspirometry of incentive is considered a therapy resource that enables the pulmonary re-expansion resoring lung's volume and capacity.

**CONCLUSION**

Before the result's analysis we conclude that the practice of inspiratometry of incentive taken out for 5 days before bariatric surgeries for obese cases is enough to increase the values of Maximum Inpiratory Pressure (Max IP), forced vital capacity (FVC) as well as maximum Expiratory Maximum, reinforcing the importance of respiratory physiotherapy during pre-surgery as a profilatic against respiratory complications.

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**EVALUATION OF BREATHING MECHANICS DURING BARIATRIC PRE-SURGERY OF MODERATE AND MORBID OBESE**

**SYNOPSIS**

The present study aims at an evaluation of breathing mechanics through muscular strength (Maximum Inspiratory Pressure - Max IP and Maximum Expiratory Pressure Max EP) and Forced Vital Capacity (FVC) in patients suffering from moderate and morbid obesity, before and after inspirometry of incentive during pre-surgery of bariatric surgery. Eleven patients were evaluated having diagnosed moderate and morbid obesity, associated or not with co-morbidity, from both sexes, with age ranging from 19 to 55, whom were to submit to bariatric surgery at Natal's Surgery Unit (UNICAD), from February 15 to May 23, 2005. A physiotherapeudic evalutation protocol was utilized as a data gathering instrument (Max IP, Max EP, FVC), control record and guidance in breathing exercises based on the UNICAD protocol. The study started upon the signing of free and conscious consent. For interference statistics a 't test' - Student was used, tuned in for verifying the differences between the average values before and after the utilization of the breathing incentivator on the group to be analysed. As a result, we were able to obtain a marked improvement for IP Max pre motivator 99.09(± 37.27), post motivator 120.45(±43.50) with p=0.048, and FVC pre motivator 3.25(±0.93), post motivator 3.45(±1) with p=0.0009. Resulting from our data analysis we concluded that the practice of incentive inspirometry witheld before bariatric surgeries in obese patients promotes the growth of Max IP, Max EF and FVC values. We would suggest our study's continuity for better validating the benefits promoted by our evaluation and guidance through pre-surgery.

KEYWORDS: bariatric, maximum inspiratory pressure, maximum expiratory pressure.

**ÉVALUATION DE LA MÉCANIQUE RESPIRATOIRE DANS LA PÉRIODE PRÉOPÉRATOIRE DE CHIRURGIE BARIATRIQUE CHEZ LES PERSONNES SOUFFRANT D'OBÉSITÉ MODÉRÉE ET MORBIDE**

**RÉSUMÉ**

La présente étude a pour objectif d'évaluer la mécanique respiratoire au travers de la force musculaire (pression inspiratoire maximale - PImax et pression expiratoire maximale - PEmax) et la capacité vitale forcée (CVF) chez des patients atteints d'obésité modérée et morbide, avant et après l'inspirométrie incitative dans la période préopératoire d'une chirurgie bariatrique. Onze patients au diagnostic d'obésité modérée ou morbide, associée ou non à des comorbidités, des deux sexes, âgés de 19 à 55 ans, qui allaient se soumettre à une chirurgie bariatrique à l'Unité Chirurgicale de Natal (UNICAD), entre le 15 février et le 23 mai 2005 ont été évalués. Lê protocole d'évaluation kinésithérapeutique, l'évaluation respiratoire (PImax,

PEmax, CVF) et la fiche de contrôle et d'orientations des exercices respiratoires basés sur le protocole de l'UNICAD ont été utilisés comme instruments pour la collecte des données. L'étude a démarré après la signature du terme de consentement libre et éclairé. Le test t-Student de comparaison a été employé à des fins statistiques pour vérifier les différences

entre les valeurs des moyennes avant et après l'emploi de l'inspirométrie incitative des groupes analysés. Le résultat obtenu est une amélioration pour la PImax pré-incitative 99,09 (±37,27), post-incitative 120,45 (±43,50) avec p=0,048 et une CVF pré-incitative 3,25 (±0,93), post-incitative 3,45 (±1) avec p=0,0009. Face à l'analyse des résultats il est conclu que la réalisation de l'inspirométrie incitative appliquée avant la chirurgie bariatrique chez lês personnes souffrant d'obésité promeut une augmentation des valeurs de PImax, CVF et PEmax. Il est suggéré une continuité de l'étude pour mieux valider les bénéfices promus par l'évaluation et les orientations

préopératoires.

Mots clés : chirurgie bariatrique, pression inspiratoire maximale, pression expiratoire maximale.

**EVALUACIÓN DEL MECANISMO RESPIRATÓRIO EN PRE-OPERATORIO DE CIRURGIA BARIATRICA EN OBESOS MODERADOS Y MÓRBIDOS**

**RESUMEN**

El actual estudio tiene como objetivo una evaluación de la mecánica respiratoria con la fuerza muscular (presión inspiratoria máxima - Max PI y presión expiratoria máxima Max PE) y la capacidad vital forzada (FVC) en los pacientes que sufren de la obesidad moderada y mórbida, antes y después inspirometria de incentivo durante pre-cirugía de la cirugía bariatrica. Fueran evaluados onze pacientes diagnosticando obesidad moderada y mórbida, asociada o no a co-morbosidad, de ambos sexos, con la edad extendiéndose a partir del 19 a 55, que eran someter a la cirugía bariatrica en la unidad natal de la cirugía (UNICAD), del 15 de febrero al 23 de mayo de 2005. Como instrumento para la colecta de datos fue utilizado un protocolo del evalutation fisioterapeutica, evaluación respiratória (Max PI , Max PE, FVC), el expediente de control y la dirección en los ejercicios de respiración basados en el UNICAD. El estudio comenzó sobre la firma del consentimiento libre y consciente. Para la estadística de interferencia al "t proba" - Student templado adentro para verificar las diferencias entre los valores medios antes y después la utilización del incentivator de respiración en el grupo analizado. Consecuentemente, podíamos obtener una mejora marcada para el Max PI pré-incentivador 99.09 (± 37.27) , el pos-motivador 120.45 (±43.50) con p=0.048, y de CVF pre-incentivador 3.25 (±0.93), pos-incentivador 3.45 (±1) con p=0.0009. Resultando de nuestro análisis de datos concluimos que la práctica de la inspirometria de incentivo aplicada antes de que las cirugías bariatrica en pacientes obesos promuevan el crecimiento del PI máxima, de los valores PE y de CVF máximos. Sugeriríamos la continuidad de nuestro estudio para mejor validar las ventajas promovidas por nuestra evaluación y dirección con pre-cirugía.
PALABRAS CLAVES: cirugía bariatrica, presión inspiratoria máxima, presión expiratoria máxima

**AVALIAÇÃO DA MECÂNICA RESPIRATÓRIA NO PRÉ-OPERATÓRIO DE CIRURGIA BARIÁTRICA EM OBESOS MODERADOS E MÓRBIDOS**

**RESUMO**

O presente estudo tem como propósito avaliar a mecânica respiratória através da força muscular (Pressão Inspiratória Máxima - PI Max e Pressão Expiratória Máxima - PE Max) e da capacidade vital forçada(CVF) em pacientes portadores de obesidade moderada e mórbida, antes e após inspirometria de incentivo no pré-operatório de cirurgia bariátrica.Foram avaliados 11 pacientes com diagnóstico de obesidade moderada e mórbida, associada ou não a co-morbidades, de ambos os sexos,com idade variando entre 19 e 55 anos, que iam se submeter à cirurgia bariátrica na Unidade Cirúrgica de Natal(UNICAD), no período de 15 de fevereiro á 23 de maio de 2005. Como instrumento para coleta de dados utilizou-se protocolo de avaliação fisioterapêutica,avaliação respiratória(PI Max,PE Max,CVF) e ficha de controle e orientações dos exercícios respiratórios baseado no protocolo da UNICAD. O estudo foi iniciado após assinatura do termo de consentimento livre e esclarecido. Para a estatística de interferência foi utilizado o teste t - Student, pareado para verificar as diferenças entre os valores das médias antes e depois do uso do incentivador respiratório dos grupos analisados. Como resultados obtivemos melhora para PIMax pré-incentivador 99,09(±37,27),pós-incentivador 120,45(±43,50) com p=0,048, e CVF pré-incentivador 3,25(±0,93),pós-incentivador 3,45(±1) com p=0,0009. Diante da analise dos resultados concluímos que a realização da inspirometria de incentivo aplicada antes da cirurgia bariátrica em portadores de obesidade, promove aumento dos valores da PImáx,CVF e PEmáx.Sugerimos continuidade do estudo para melhor validar os benefícios promovidos pela avaliação e orientações no pré-operatório.

Palavras-chave:cirurgia bariátrica, pressão inspiratória máxima, pressão expiratória máxima.