Original Article

The use of Borg's modified scale in asthma crises*

Uso da escala modificada de Borg na crise asmática

Uso de la escala modificada de Borg en la crisis asmática

Tatiana de Medeiros Colletti Cavalcante[1], Solange Diccini[2], Dulce Aparecida Barbosa[2], Ana Rita de Cássia Bittencourt[2]

ABSTRACT

Objective: Verify the correlation of the improvement of the degree of dyspnea by BME with improved pulmonary performance verified by Expiratory Flow Peak (EFP) and Peripheral Oxygen Saturation (PO_2S). **Methods:** Analytical, cross-sectional study with 124 patients during an asthma crisis, who received care at a Pneumology emergency service. Heart rate, respiratory frequency EFP, PO_2S were evaluated before and after treatment of asthma crisis, and they were questioned about their perception of dyspnea by BME. **Results**: In the pre-treatment stage, high scale values were related to low EFP values, inverting this relation after treatment. There was also a slight correlation between EFP, PO_2S and the perception of dyspnea measured by the patient through BME. **Conclusion**: The scale does not replace other clinical parameters, and can be used as an additional tool, provided that the patient is correctly informed about the scale values.

Keywords: Dyspnea; Asthma; Scales

RESUMO

Objetivo: Verificar a correlação da melhora do grau de dispnéia pela EMB com a melhora da função pulmonar verificada pelo Pico de Fluxo Expiratório (PFE) e Saturação Periférica de Oxigênio (spO_2). **Métodos:** Estudo analítico e transversal com 124 pacientes em crise asmática atendidos em um Pronto-Atendimento em Pneumologia. Foram avaliados antes e após o tratamento da crise asmática: frequência cardíaca, frequência respiratória, PFE, SpO_2 e questionados sobre sua percepção da dispnéia pela EMB. **Resultados:** Na fase pré-tratamento, valores altos da escala estavam relacionados a valores baixos de PFE, invertendo esta relação no pós-tratamento. Houve também uma fraca correlação entre o PFE, SpO_2 e a percepção da dispnéia mensurada pelo paciente através da EMB. **Conclusão:** A escala não substitui outros parâmetros clínicos, podendo ser utilizada como uma ferramenta adicional, desde que o paciente seja corretamente informado sobre os valores da escala.

Descritores: Dispnéia; Asma; Escalas

RESUMEN

Objetivo: Verificar la correlación de la mejoría del grado de disnea por medio de la EMB con la mejora de la función pulmonar verificada por el Pico de Flujo Expiratorio (PFE) y Saturación Periférica de Oxígeno (spO_2). **Métodos:** Estudio analítico y transversal realizado con 124 pacientes en crisis asmática atendidos en un Servicio de emergencia de neumología. Fueron evaluados antes y después del tratamiento de la crisis asmática: frecuencia cardiaca, frecuencia respiratoria, PFE, SpO_2 e interrogados sobre su percepción de la disnea por medio de la EMB. **Resultados:** En la fase de pre-tratamiento, los valores altos de la escala estaban relacionados a los valores bajos de PFE, invirtiéndose esta relación en el post-tratamiento. Hubo también una débil correlación entre el PFE, SpO_2, y la percepción de la disnea mensurada por el paciente a través de la EMB. **Conclusión:** La escala no sustituye otros parámetros clínicos, pudiendo ser utilizada como una herramienta adicional, siempre y cuando el paciente sea correctamente informado sobre los valores de la escala.

Descritores: Disnea; Asma; Escalas

Corresponding Author: **Ana Rita de Cássia Bittencourt**
R. Napoleão de Barros, 754 - Vila Clementino - São Paulo - SP
Cep: 04024-002. E-mail: anarita@denf.epm.br

INTRODUCTION

Asthma is a potentially deadly chronic inflammatory disease characterized by bronchial hyper-reactivity to several stimuli. Despite the stabilization in the prevalence of asthma in some countries, mortality due to this disease is still high. In Brazil, in 2000, the mortality rate by asthma as the basic or associated cause was 2.29 per 100,000 inhabitants[1].

Recent DATASUS hospital morbidity data from the Single Health System per hospitalizationhospitalization place show the occurrence of 22,667 hospitalization-hospitalizations due to asthma per municipality in Brazil, in September/2006, with 86 deaths[2].

Asthma crises may be associated to a sudden or gradual onset[3]. The asthmatic crisis is a very common medical emergency. It is responsible for the use of a significant share of emergency room resources, with a high hospitalization rate[4-5].

In patients with respiratory problems, dyspnea is one of the most common symptoms, and it can show significant complications, implying the risk of asphyxia by lack of adequate treatment[6].

The perception of the symptom is defined as the patient's conscious sensation of a physiological problem, the result of a series of events: activation of the afferent endings by physiopathological stimulation, information transmission and processing in the nerve ways, interpretation at the brain cortex and finally, recognition by the patient[7].

Failure in perceiving the severity of bronchoconstriction logically results in a delay to seek help, inadequate use of effective medication, and can even lead to avoidable deaths. On the other hand, the excessive perception of modest bronchoconstriction logically results in the early search for help, overuse of healthcare services and potential iatrogenesies as side effects[8]. As such, the perception of the asthma patient about the severity of bronchoconstriction has been reported as very important in the effective handling of asthma.

The relation between the intensity of perception and the intensity of the stimulus cam be quantified by using the detection of the stimulus or by employing technical scales. The latter yield more information, but require the subject to judge it quantitatively and to translate it to an appropriate scale, somewhat more complex than the simple yes/no answer[9].

In this study, we decided to use Borg's Modified Scale to quantify dyspnea, since this is the most commonly used method, and its measurement is performed directly, whenever the patient is having the sensation.

In the face of this reality, it is known that delays in the application of therapy can often deteriorate the patient's clinical situation, even to the extent of leading to death.

Since the nurse is the professional who has the first contact with the patient, upon arrival, we believe that, if this professional is well supported by tools that aid in the evaluation of the gravity of dyspnea, such as BME, therapy can be started early and several deaths can be avoided.

Thus, we aim to verify the correlation between the improvement of the severity of dyspnea using BME, and the improvement in lung function verified by the Expiratory Flow Peak (EFP) and Peripheral Oxygen Saturation (PO$_2$S)

METHODS

This analytical, cross-sectional study was developed at the Pneumology Emergency Service of a large public hospital in the metropolitan region of São Paulo, Brazil, from June/2005 till July/2006.

The sample was constituted by patients with an asthma crisis diagnosis[1], of both genders and over 12 years old. Smoking patients over 50 years old were excluded, as well as patients smoking for more than 30 years; patients with chronic respiratory diseases, such as Chronic Obstructive Pulmonary Disease and bronchitis, and with previous or associate pulmonary diseases resulting in sequels, such as tuberculosis, thoracic surgery, etc; patients with acute respiratory infection of the lower airways, characterized by at least two out of three findings: fever, purulent expectoration or pulmonary infiltration in the thoracic radiogram; patients with certified heart or kidney disease; patients incapable of measuring EFP adequately, due to lack of collaboration or any other reason, and patients who had participated in this study before.

In total, 161 patients with diagnosed asthma and during an asthma crisis were assessed. Nine patients were excluded due to associated chronic pneumopathies; five had been smoking for more than 30 years; two had a heart disease; seven presented signs and symptoms of acute respiratory infection of the lower airways; 11 had participated in this study before and three did not agree to sign the term of consent. Therefore, 124 patients were included in the study.

This research was approved by the Review Board of Universidade Federal de São Paulo, filed under number 0333/05, and the patients signed the respective term of consent.

After the arrival of the patient, during a bronchospasm crisis, he underwent a medical appointment, when the evaluation, diagnosis and medication prescription were performed. The treatment was executed according to the III Consenso Brasileiro no Manejo da Asma 2002[10].

After this evaluation, the patient was referred to the Nursing Station, where he was treated. Immediately after his arrival, he was informed about the study and, after

consenting, some data were collected before treatment was started: Oxygen Saturation (PO_2S), heart rate (HR), respiratory frequency (RF), hissing, dyspnea, use of accessory musculature and EFP. Patients were asked about their sensation of dyspnea through BME, which is a vertical scale quantified from 0 to 10, where 0 stands for no symptoms and 10 stands for maximum symptoms (Chart 1).

Chart 1 – Borg's modified scale, as used in Brazil

0	None
0.5	Very, very light
1	Very light
2	Light
3	Moderate
4	Not very intense
5	Intense
6	
7	Very intense
8	
9	Very, very intense
10	Maximum

The patients were free to choose any of the ratings, and were carefully instructed not to pay attention to other types of sensation, such as nasal and throat irritation.

The use of accessory musculature was defined as a visible retraction of this same musculature, and was classified according to data from literature[11] in: absent, light intercostal retractions, strong subcostal and/or sternocleidomastoid retraction and strong or declining retraction. Hissing was defined as musical sounds, audible with the aid of a stethoscope during breathing. They were graded on a 0-to-3 scale, where 0 meant absent, 1 - light (audible in one pulmonary field), 2 – moderate (audible in two pulmonary fields) and 3 – grave (spread through all pulmonary fields)[11].

The measurement of the EFP was performed with the patient sitting, using the Peak Flow Monitor portable device (Boehringer Ingelheim). Successive expiratory maneuvers were performed, and the maneuver with the highest value was registered. The result was expressed in percentages according to gender, age and height, in line with worldwide consensual guidelines[1,10,12-16]. These measurements were performed at intervals: before administering the treatment and 15 minutes after each treatment performed, up to a maximum of three treatments, according to the precepts of the current literature[1].

After the described measurements were taken, the patients were classified in three groups: one with a light/moderate crisis, another with a grave crisis and the third, with very grave crisis. This classification was based on the III Consenso Brasileiro no Manejo da Asma 2002 and

on the immediately-instituted treatment[10].

After the groups were separated, all patients received four streams, totaling 400 mcg salbutamol and 80 mcg ipratropium bromide (combivent spray - Boehringer Ingelheim), using a metered-dose inhaler connected to a 750 ml suspension chamber (Fisionair). Each stream was administered at 30-second intervals. This setup could be provided up to three times, with a 15-minute interval between each treatment.

Data were collected prior to the first treatment and 15 minutes after each medication application. Patients were followed until they were discharged or broke the protocol.

Fifteen minutes after administering the therapy, the patients had their HR, RF, PO_2S, EFP and BME values reevaluated.

The evaluation of the pulmonary function by EFP determined the end or the continuation of the treatment. The therapeutic scheme was interrupted when the patients reached a pre-established EFP functional value equal to or higher than 70% of the predicted value, and were discharged after 30 minutes in observation, being reevaluated at the end of this period in order to detect a functional relapse. When EFP > 70% of the predicted value was reached, the patients were discharged, with a maintenance therapy tailored to each case. In cases when the EFP did not reach 70% of the predicted value, the treatment was restarted, following the sequence of the therapeutic scheme until this value could be reached.

The patients whose EFP was under 70% of the predicted value after the third treatment were considered as therapeutic failures and breaks of the inhalatory protocol. In these cases, the patients received the predicted medications in sequence, according to the III Consenso Brasileiro no Manejo da Asma 2002[10].

Parametric and non-parametric tests were used to analyze the data, considering the nature of the studied variables or the variability of the performed measurements. The following tests were applied: Student's t, paired with the purpose of comparing pre- and post-treatment in relation to HR, RF, PO_2S and EFP; signaled Wilcoxon's test for the evaluation of BME due to high data variability; grouped distribution analysis of two qualitative variables for the evaluation of pre- and post-Borg treatment and Spearman's rank correlation coefficient to evaluate the association between the variations in EFP and BME parameters.

In all tests, the level to reject the null hypothesis was set at 5%, or 0.05, and significant values were marked with an asterisk.

RESULTS

124 patients with asthma diagnosis were evaluated in

this study.

The data referring to the general characteristics of the patients with asthma crisis who received care at a Pneumology emergency service are presented in Table 1.

Table 1 – General characteristics of patients with asthma crisis who received care at a Pneumology emergency service. June/2005 to July/2006

Age, median (min – max)	44.5 years old (12 – 79)
Weight, median (min – max)	65.5 Kg (21 – 128)
BMI, median (min – max)	27.7 Kg/m² (17 – 45)
Gender	n (%)
Male	19 (15.3)
Female	105 (84.7)
Ethnicity	n (%)
White	63 (50.8)
Mixed	61 (49.2)
Educational level	n n (%)
Illiterate	6 (4.8)
Unfinished Primary educationl	70 (56.5)
Finished Primary Education	13 (10.5)
Unfinished Secondary Education	2 (1.6)
Finished Secondary Education	27 (21.8)
University	6 (4.8)
Marital Status	n (%)
Single	48 (38.7)
Married	54 (43.5)
Divorced	14 (11.3)
Widowed	8 (6.5)
Smoking	n (%)
Yes	40 (32.3)
No	84 (67.7)
Profession	n (%)
Retired	3 (2.4)
Commerce	20 (16.1)
General repairs	10 (8.1)
Unemployed	6 (4.8)
Student	10 (8.1)
Chemical Industry	5 (4.0)
General Services	54 (43.6)
Other	16 (12.9)

According to Table 1, most patients were female (84.7%), white (50.8%), married (43.5%), non-smoking (67.7%), and the most common profession was general services (43.6%).

The time of asthma for these patients varied from 3 months to 73 years, with a median time of 19 years.

Table 2 shows the distribution of these patients, according to the intensity of the asthma crisis upon admission, revealing that most patients' crisis could be rated as light/moderate.

Table 3 shows the result of the objective evaluation of the gravity of the asthma crisis, before and after the treatment, according to the crisis groups.

Comparing the period before the beginning and that after the last treatment, a statistically significant difference

was observed for the variables HR, RF, EFP in liters and BME in all groups. The only group where PO_2S showed no significance was the Light/Moderate crisis group.

Table 2 – Distribution of patients under care at a Pneumology emergency service, according to the intensity of their asthma crisis. June/2005 to July/2006

Crisis intensity	n (%)	RI at 95%
Light/Moderate	66 (53.2)	[44.1% ; 62.2%]
Grave	35 (28.2)	[20.5% ; 37.0%]
Very Grave	23 (18.6)	[12.1% ; 26.5%]
Total	**124 (100.0)**	

Table 3 – Patients under care at a Pneumology emergency service, according to the objective evaluation of the gravity of the asthma crisis before the beginning and after the last treatment. June/2005 to July/2006

Light/Moderate Crisis	Before	After	p-value
HR [2]	80.8 ± 12.1 (58 – 107)	78.0 ± 12.6 (59 – 120)	0.004*
RF [2]	21.7 ± 3.3 (16 - 30)	18.4 ± 2.9 (12 – 24)	<0.001*
PO₂S [2]	96.4 ± 1.5 (93 – 99)	96.6 ± 1.2 (94 – 99)	0.133
EFP [2]	252.1 ± 38.0 (190 – 400)	341.8 ± 62.2 (260 – 600)	<0.001*
BORG [1,3]	3.0 (1 – 9)	0.0 (0 – 3)	<0.001*
Grave Crisis			
HR [2]	88.8 ± 15.5 (65 – 143)	80.2 ± 13.3 (65 – 135)	<0.001*
RF [2]	22.9 ± 3.3 (16 - 30)	18.4 ± 4.0 (12 – 30)	<0.001*
PO₂S [2]	95.8 ± 1.5 (92 – 98)	96.6 ± 0.7 (95 – 98)	0.003*
EFP [2]	191.4 ± 51.3 (100 – 300)	314.6 ± 51.8 (210 – 410)	<0.001*
BORG [1,3]	3.0 (1 – 9)	0.0 (0 – 7)	<0.001*
Very Grave Crisis			
HR [2]	89.4 ± 17.1 (66 – 140)	82.3 ± 15.3 (64 – 135)	<0.001*
RF [2]	27.4 ± 6.4 (16 - 40)	19.4 ± 3.1 (14 – 26)	<0.001*
PO₂S [2]	94.4 ± 2.4 (89 – 98)	95.6 ± 1.8 (91 – 97)	<0.001*
EFP [2]	166.1 ± 46.0 (100 – 250)	300.4 ± 60.7 (190 – 410)	<0.001*
BORG [1,3]	5.0 (2 – 10)	1.0 (0 – 7)	<0.001*

Tests: 1 Median, 2 Paired t-test, 3 Signalized Wilcoxon. HR: Heart rate, RF: Respiratory frequency, PO_2S: Oxygen saturation, EFP: Expiratory Flow Peak and BORG: Value of Borg's Modified Scale.

When the grouped BME distribution was performed before the beginning and after the last treatment in the 124 patients, a significant improvement was observed in relation to the value attributed to dyspnea by this scale upon admission and after treatment, except in one patient.
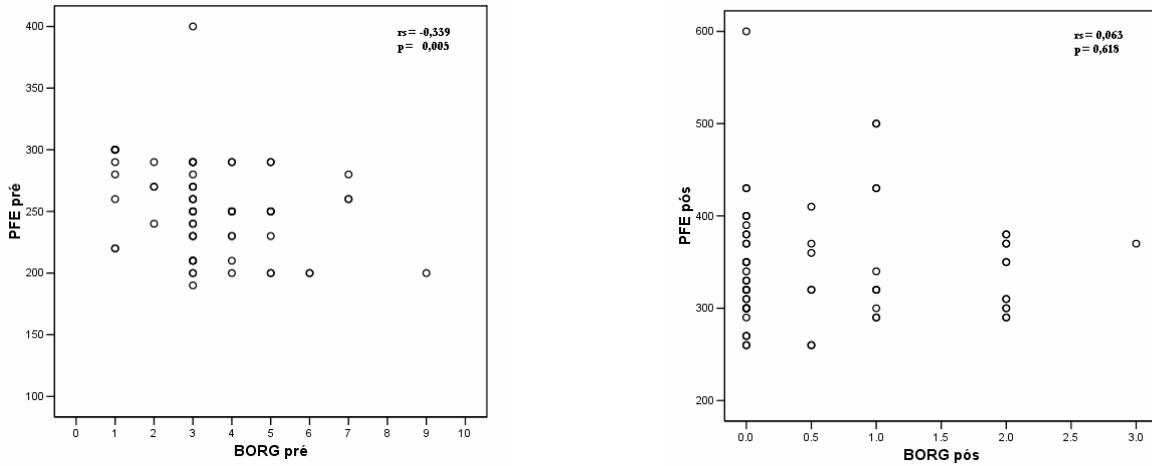
Figure 1 – Correlation between the BME and EFP values in liters before and after the last treatment in patients with Light/Moderate crises, under care at a Pneumology emergency service. June/2005 to July/2006
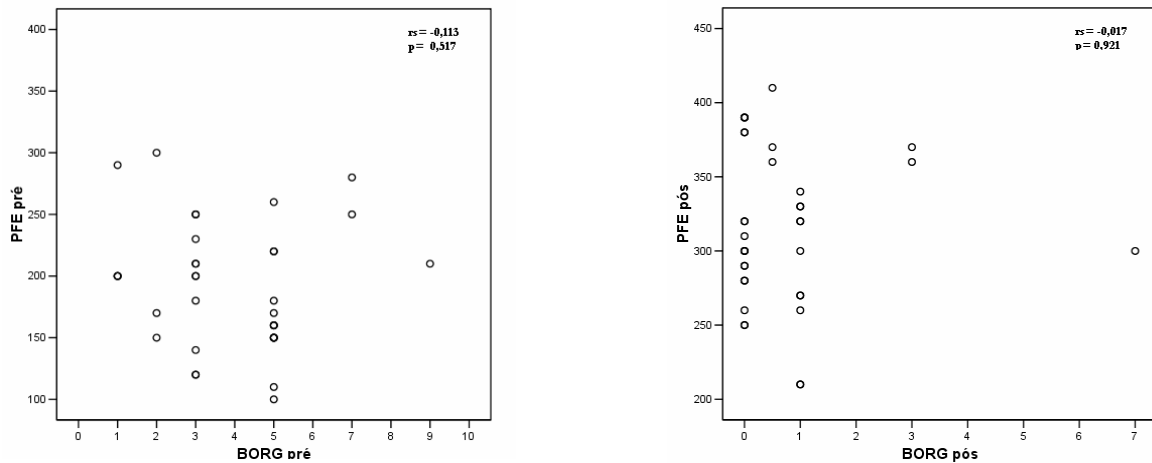

Figure 2 – Correlation between the BME and EFP values in liters before and after the last treatment in patients with Grave crises, under care at a Pneumology emergency service. June/2005 to July/2006.
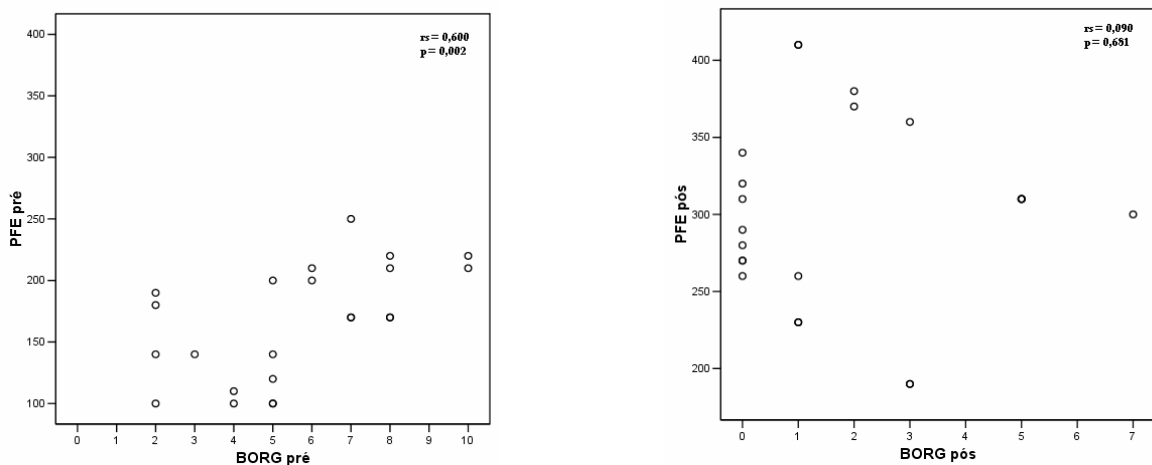

Figure 3 – Correlation between the BME and EFP values in liters before and after the last treatment in patients with Very Grave crises, under care at a Pneumology emergency service. June/2005 to July/2006.

In Figure 1, a significant negative correlation is observed between EFP and BME before treatment in patients with Light/Moderate crisis (rs= -0.339 and p= 0.005*) and a non-significant positive correlation between EFP and EMB after treatment (rs=0.063 and p=0.618).

Figure 2 shows a non-significant correlation between EFB and EMB before the beginning of the treatment in patients with a Grave crisis (rs= -0.113 and p= 0.517) and after the last treatment (rs=-0.017 and p=0.921)

In Figure 3, a statistically significant positive correlation between EFP and BME before the beginning of the treatment (rs= 0.600 and p= 0.002*) can be observed. After the last treatment, however, the positive correlation was maintained, but it was not significant (rs=-0.090 and p=0.681).

In all groups, it was observed that the highest BME values are associated to lower EFP volumes in liters, while higher EFP values at the end of the treatment are associated to lower BME values, except in one case.

No significant correlations were observed among the groups when correlation tests were performed between the BME and PO_2S values, before and after the treatment.

DISCUSSION

In our study, all patients included had a previous asthma diagnosis from a physician, based on the symptoms and complementary exams, in accordance with the guidelines[1,10,12-16].

The asthma crisis was more frequent in women, which can be explained by the results of other studies, which identify that women have a higher bronchial response than men, almost exclusively because of the caliber of their airways[17-20].

The educational level is the most usual indicator of socioeconomic level for adults, because it is generally not altered. Other indicators are income and occupation; however, the former was not evaluated in this research. Low educational level, marital status, profession and levels of anxiety usually relate with a higher frequency of asthma exacerbation[21-23]. For some authors, educational level and profession are the best indicators to probably describe occupational exposure[23].

In the present study, most patients with an asthma crisis were female, with an average age of 44.5 years, low educational level, and who worked in general services, often handling chemical products. This is in accordance with most studies[17-23].

A quarter of the patients were smokers. Although some studies have shown that smoking is not a risk factor for asthma in adults, it is known that smoking increases the gravity of asthma and can be an obstacle to control this disease. The association between smoking and asthma is a complex one. In one study, an association between the risk of asthma and the amount of cigarettes smoked was found only in women[23].

During the research, patients between 12 and 79 years of age were admitted. Elderly patients and children over 8 years old were not excluded, since the bronchodillating response to salbutamol, as well as ipratropium bromide, in asthma, does not vary with age[25].

In this study, due to technical reasons, the EFP was the only one used as a pulmonary functional variable. Even though spirometry is considered the best method to evaluate the limitation of air flow in asthma, EFP measurement is easier to perform in emergency services. Besides, the devices used for EFP are less expensive and more readily available at this sector[26].

In our study, patients with varied levels of airflow obstruction were selected, from light/moderate crisis to very grave crisis. The data about the history of the current crisis, which denote gravity for some authors, include a prolonged duration of the symptoms, delays in seeking medical help, exacerbation during corticotherapy and adequate bronchodillating treatment, receding symptoms within hours or few days of emergency care. Other factors related to higher mortality are age over 55 years old and the presence of comorbidities[27].

When compared at the early clinical presentation and evolution after therapy, in patients with light or moderate grave or very grave asthma crisis, HR, RF, EFP in liters and the BME evaluation were statistically significant. PO_2S was only statistically significant in patients with grave and very grave crisis.

BME seemed to be a quick, inexpensive and easily applicable instrument in the evaluation of patients with asthma. It can be used by healthcare professionals during the initial evaluation of patients with asthma crisis, as well as to evaluate their response to treatment. Since this scale is easily applicable, we chose to use it at the emergency service. Indeed, in our study, there were no difficulties in applying BME, and the patients did not consider its rating scale difficult to understand.

When the BME values are evaluated before and after the last treatment, we observed a significant improvement in all patients regarding the values attributed by this scale, regardless of the type of crisis. Among the studies performed so far using BME, none evaluated pre- and post-treatment BME; what was actually evaluated was the correlation of the scale with the EFP volumes or Forced Expiratory Volume.

A correlation test between the BME values and the EFP values in liters before the treatment and 15 minutes after the last treatment showed a significant correlation in patients with light or moderate asthma, and those with very grave asthma before treatment, which did not occur in grave asthma, either before or after treatment. In all figures, there is evidence that higher BME values upon

admission are associated to lower EFP values in liters before treatment, while higher EFP values are associated to lower BME values after the last treatment. Studies show that asthmatic patients present varied degrees of anxiety and depression when compared to the general population, which may interfere in their sensation of dyspnea[28-29].

When the EMB values are correlated with the PO_2S values before treatment and 15 minutes after the last treatment, none of the groups showed statistical significance, although the saturation values, as expected, had increased after treatment and the BME values had decreased.

Another point that can be considered is that, although the use of metered-dose inhalers is effective and less expensive than the usual inhalations, patients and healthcare professionals find it difficult to abandon the use of such inhalations. They believe that these are more effective because, as the patient inhales for approximately 20 minutes, the benefits are more perceptible at the end of the inhalation. It may take longer to achieve the benefits of using metered-dose inhalers, however, which may cause the false impression that they are less effective[30]. We believe that this fact, by itself, can make patients continue to signal a given value for BME even after

reaching an EFP > 70%, because they do not believe in the treatment.

CONCLUSION

The results obtained in this study demonstrate a weak correlation between the degree of bronchoconstriction, evaluated by EFP and PO_2S, and the perception of dyspnea measured by the patient and evaluated by BME.

The statistical correlation between EFP, PO_2S and BME showed that the latter can be useful to evaluate the sensation of dyspnea, but it was not shown to be specific enough to evaluate the degree of asthma severity due to a weak correlation. This weak correlation can be a consequence, among other factors, of phenomena of adaptation to hypoxia or even emotional phenomena involved, according to literature.

Our study contributes to the theme by showing that BME, although widely used in the evaluation of induced bronchoconstriction by exercise, does not substitute any other clinical parameter in the individual with asthmatic crisis. It can be useful only as an additional tool, provided that the patient is correctly informed about the values of the scale by a capable healthcare professional, like in the case of nurses.

REFERENCES

1. IV Diretrizes Brasileiras para o Manejo da Asma. J Bras Pneumol. 2006; 32(Supl 7): S447-S74.
2. Brasil. Ministério da Saúde. DATASUS [Internet]. Morbidade Hospitalar do SUS - por local de internação – Brasil. [citado 2007 Mar 20]. Disponível em: http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sih/cnv/mibr.def .
3. Souza-Machado A, Cavalcanti MN, Cruz AA. Má percepção da limitação aos fluxos aéreos em pacientes com asma moderada a grave. J Pneumol. 2001; 27(4):185-92.
4. Rodrigo GJ, Rodrigo C, Hall JB. Acute asthma in adults: a review. Chest. 2004; 125(3): 1081-102. Comment in: Chest. 2005; 127(5):1867.
5. McFadden ER Jr. Acute severe asthma. Am J Respir Crit Care Med. 2003; 168(7): 740-59.
6. Cruz AA. Pico de fluxo expiratório: é melhor medir! J Bras Pneumol. 2006; 32(1): iv-vi.
7. Turner MO, Noertjojo K, Vedal S, Bai T, Crump S, Fitzgerald JM. Risck factors for near-fatal asthma. A case-control study in hospitalized patients with asthma. Am J Respir Crit Care Med. 1998; 157(6 Pt 1): 1804-9. Comment in: Am J Respir Crit Care Med. 1999; 159(4 Pt 1):1355-6.
8. Banzett RB, Dempsey JA, O´Donnell DE, Wamboldt MZ. Symptom perception and respiratory sensation in asthma. Am J Respir Crit Care Med. 2000; 162(3 Pt 1): 1178 -82.
9. Lansing RW, Banzett RB. Psychophysical methods in the study of respiratory sensation. In: Adams L, Guz A, editors. Respiratory sensation: lung biology in health and disease. New York: Marcel Dekker; 1996. p. 125-54.
10. Sociedade Brasileira de Pneumologia e Tisiologia. III Consenso Brasileiro no Manejo da Asma 2002. J Pneumol. 2002; 28(Supl 1):S1-S28
11. Rodrigo GJ, Rodrigo C. Rapid-onset asthma attack: a prospective cohort study about characteristics and response to emergency department treatment. Chest.

2000;118(6):1547-52.
12. National Asthma Education Prevention Program. Expert Panel Report II: Guidelines for the Diagnosis and Management of Asthma. NIH Publication No 97-4051. Bethesda, National Institutes of Health, 1997.
13. National Asthma Education and Prevention Program. National Asthma Education and Prevention Program. Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma Update on Selected Topics—2002. J Allergy Clin Immunol. 2002; 110(5 Suppl):S141-219. Erratum in: J Allergy Clin Immunol. 2003; 111(3):466.
14. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention 2006.[Internet]. [cited 2007 Jan 31]. Available from: http://www.who.int/respiratory/asthma/GINA_WR_2006_copyright%5B1%5D.pdf
15. National Asthma Council Australia. *Asthma Management Handbook 2006.* [Internet]. Melbourne; 2006. [cited 2007 Jan 31].Available from: http://www.nationalasthma.org.au/cms/images/stories/amh2006_web_5.pdf
16. National Library for Health. National Library of Guidelines Specialist Library. British guideline on the management of asthma: a national clinical guideline [Internet]. [cited 2007 Jan 31]. Available from: http://www.library.nhs.uk/GuidelinesFinder/ViewResource.aspx?resID=266961&tabID=288
17. Chatkin JM, Barreto SM, Fonseca NA, Gutiérrez CA, Sears MR. Trends in asthma mortality in young people in southern Brazil. Ann Allergy Asthma Immunol. 1999; 82(3): 287-92. Comment in: Ann Allergy Asthma Immunol. 1999; 83(6 Pt 1):572-3.
18. Aguiar Filho AS, Lopes Neto EPA, Sarinho ESC, Vasconcelos MM, Lima DST, Wirtsbiki PM. Prevalência de asma em funcionários de hospital universitário avaliada por meio de questionário de saúde respiratória da Comunidade Européia. J Bras Pneumol. 2005; 31(5):390-7.

19. Arif AA, Delclos GL, Lee ES, Tortolero SR, Whitehead LW. Prevalence and risk factors of asthma and wheezing among US adults: an analysis of the NHANES III data. Eur Respir J. 2003; 21(5):827-33.
20. Varraso R, Siroux V, Maccario J, Pii I, Kauffmann F; Epidemiological Study on the Genetics and Environment of Asthma. Asthma severity is associated with body mass index and early menarche in women. Am J Respir Crit Care Med. 2005; 171(4):334-9.
21. Schatz M, Clark S, Camargo CA Jr. Sex differences in the presentation and course of asthma hospitalizations. Chest. 2006; 129(1):50-5.
22. Retamales Rojas R. Factores psicológicos y rasgos de personalidad de enfermos alérgicos referidos para interconsulta. Rev Eletrônica Psicol [Internet] 1998 [citado 2007 mar 12];2(1). Disponível em: http://www.psiquiatria.com/psicologia/vol2num1/art_4.htm
23. Weinstein AG. Should patients with persistent severe asthma be monitored for medication adherence? Ann Allergy Asthma Immunol. 2005; 94(2): 251-7.
24. Huovinen E, Kaprio J, Laitinen LA, Koskenvuo M. Social predictors of adult asthma: a co-twin case-control study. Thorax. 2001; 56(3):234-6.
25. Siroux V, Pin I, Oryszczyn MP, Le Moual N, Kauffmann F. Relationships of active smoking to asthma and asthma severity in the EGEA study. Epidemiological study on the Genetics and Environment of Asthma. Eur Respir J. 2000; 15(3): 470-7. Comment in: Eur Respir J. 2000; 16(3):574-5.
26. Piovesan DM, Menegotto DM, Kang S, Fransciscatto E, Millan T, Hoffmann C, et al. Avaliação prognóstica precoce da asma aguda na sala de emergência. J Bras Pneumol. 2006; 32(1): 1-9.
27. Dalcin PTR, Medeiros AC, Siqueira MK, Mallmann F, Lacerda M, Gazzana MB, Barreto SSM. Asma aguda em adultos na sala de emergência: o manejo clínico na primeira hora. J Bras Pneumol. 2000; 26(6): 297-306.
28. Adams RJ, Smith BJ, Ruffin RE. Factors associated with hospital admissions and repeat emergency department visits for adults with asthma. Thorax. 2000; 55(7): 566-73.
29. Cavallazzi TGL, Cavallazzi RS, Cavalcante TMC, Bettencourt ARC, Diccini S. Avaliação do uso da Escala Modificada de Borg na crise asmática. Acta Paul Enferm. 2005; 18(1):39-45.
30. Greaves CJ, Eiser C, Seamark D, Halpin DM. Attack context: an important mediator of the relationship between psychological status and asthma outcomes. Thorax. 2002; 57(3): 217-21. Comment in: Thorax. 2002; 57(3):190-1.