VALIDITY OF ASTHMA CONTROL TEST IN ASSESSMENT OF THE LEVEL OF CONTROL IN ASTHMATIC CHILDREN

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ABSTRACT

Background: So far, in Egypt, there has been no effective or easy procedure to define the control of asthma. This study To assess the validity of asthma control test in assessment of level of control in asthmatic children visiting the allergy and pulmonology clinic; Al-Hussein Hospital ; Al-azhar University and the outpatient clinic; Sohag Teaching Hospital, Sohag governorate, Upper Egypt.

Methods: This is a prospective comparative study was done from 6/2015 to 7/2016 on one hundred asthmatic children of both sexes, in the age group between six and twelve years, Inclusion criteria:
1. Documented asthmatic children
2. Age 6-12 years
3. Different level of control

Exclusion criteria:
1. Children less than 6 years of age
2. Children with chronic chest diseases rather than asthma
3. Children with congenital or rheumatic heart diseases
4. Children with hospital admission in the last 4 weeks

All children was divided into controlled and uncontrolled asthma groups. All patients were classified according to GINA guidelines 2014 into 4 subgroups: intermittent, mild persistent, moderate persistent and severe persistent asthma. All of them completed the Asthma Control Test (ACT) and the Peak Expiratory Flow Meter (PEFM) at the allergy and pulmonology clinic; Al-Hussein Hospital; Al-azhar University and the outpatient clinic; Sohag Teaching Hospital, Sohag governorate, Upper Egypt. (8 weeks apart).

Results: Regarding ACT and PEFM scores, we found that both increased steadily from the 1st week to the 8th week. This rise is statistically significant from as early as the second week, with highly significant differences (P Value <0.001).

ACT was significantly better among controlled than uncontrolled patients from the 1st to 6th weeks. On the other hand, PEFM was significantly higher among controlled than uncontrolled patients in the first week only (P Value<0.001).

There was a steady increase in the control percentages of cases compared to the first week taken as the baseline; this was statistically significant from as early as the second week (P 0.015**,** 0.129, 0.862, 0.649, 0.524, 0.514, 0.513, 0.715 respectively).

Conclusion: Asthma Control Test (ACT) is a useful and simple method for the evaluation of asthma severity and control among children in Egypt.

INTRODUCTION

Asthma is still one of the high mortality associated diseases, with high medical, economic and social burden despite the advances in the understanding of the pathophysiology of asthma, the availability of effective preventive therapy, and the continuous advances in international treatment guidelines. It is estimated that 300 million people of all ages and diverse ethnicities suffer from asthma, and about 1 in every 250 is estimated to die from asthma worldwide [(1)].

Asthma is a serious global health problem affecting all age groups, with increasing prevalence in many developing countries, rising treatment costs, and arising burden for patients and the community [(2)].

The prevalence of physician-diagnosed asthma in Egypt is around 10%. There is a higher prevalence and increased severity of asthma symptoms in children of lower socioeconomic groups, as defined by state school attendance in Egypt [(3)].

Effective asthma treatment requires routinely tracking symptoms and measuring how well your lungs are working. Taking an active role in managing asthma treatment will help to maintain better long-term asthma control, prevent asthma attacks and avoid long-term problems [(4)].

The Asthma Control Test (ACT) is a multidimensional, standardized, and validated tool and the most widely used tool for assessing asthma control in patients with asthma older than 12 years. Similar to most asthma assessment tools, the ACT quantifies asthma control as a continuous variable and provides a numeric value to distinguish between controlled and uncontrolled asthma [(5)].

The ACT is a patient-centered/ completed questionnaire that recalls the patient's experience of 5 items: asthma symptoms (nocturnal and daytime), the use of rescue medications, the effect of asthma on daily functioning, and the patient's perception of asthma control over the previous 4 weeks. Each item includes 5 response options corresponding to a 5-point Likert-type rating scale. Subsequently, responses for each of the 5 items are summed to yield a

score ranging from 5 (poor asthma control) to 25 (complete asthma control) [1, 5-9].

AIM OF THE STUDY

This study aimed to assess the validity of asthma control test in assessment of level of control in asthmatic children visiting the allergy and pulmonology clinic; Al-Hussein Hospital; Al-azhar University and the outpatient clinic; Sohag Teaching Hospital, Sohag governorate, Upper Egypt.

PATIENTS AND METHODS

Type of the study:

It is a prospective comparative study.

Patients:

This study was done from 6/2015 to 7/2016 on one hundred asthmatic children of both sexes, in the age group between six and twelve years, divided into controlled and uncontrolled asthma groups.

Inclusion criteria:

1. Documented asthmatic children
2. Age 6-12 years
3. Different level of control

Exclusion criteria:

1. Children less than 6 years of age.
2. Children with chronic chest diseases rather than asthma
3. Children with congenital or rheumatic heart diseases
4. Children with hospital admission in the last 4 weeks

Methods:

All patients were classified according to GINA guidelines 2014 [10] into four subgroups: intermittent, mild persistent, moderate persistent and severe persistent asthma. Patients were subjected to "the asthma control test" (ACT) score at the beginning of the study (primary test) in order to subdivide the asthmatic children into:

- Group (1) controlled asthmatic children.
- Group (2) uncontrolled asthmatic children.

Plan of the management was optimized to each group according to GINA guidelines [10] for one month and the patient was followed using the ACT for a period of 8 weeks.

Patient with clinical diagnosis of asthma were subjected to:

1. Full history
2. General and chest examination
3. Asthma control test (ACT)
4. Peak expiratory flow meter (PEF)

Asthma Control Test

The ACT is a multidimensional, standardized, and validated tool and the most widely used tool for assessing asthma control in patients with asthma older than 12y. Similar to most asthma assessment tools, the ACT quantifies asthma control as a continuous variable and provides a numeric value to distinguish between controlled and uncontrolled asthma[22] .

According to 2008 GINA guidelines, [23] which have the same definition and criteria of asthma control as the 2015 GINA guidelines, an ACT score of >23 and a score <19 indicates well-controlled asthma [24] and uncontrolled asthma, respectively [25]. A cutoff score of <19 was associated with higher risk of adverse asthma outcomes, such as asthma exacerbation [26] and urgent health-care utilization [27]. With regard to NAEPP EPR-3 guidelines, a score of >20 indicates well-controlled asthma, a score of 16–19 indicates not well-controlled asthma, and a score of<15 indicates very poorly controlled asthma [28].

Childhood Asthma Control Test for children 4 to 11 years.

How to take the Childhood Asthma Control Test

- Step 1: Let your child respond to the first four questions (1 to 4). If your child needs help reading or understanding the question, you may help, but let your child select the response. Complete the remaining three questions (5 to 7) on your own and without letting your child's response influence your answers. There are no right or wrong answers.
- Step 2: Write the number of each answer in the score box provided.
- Step 3: Add up each score box for the total.
- Step 4: Take the test to the doctor to talk about your child's total score.

If your child's score is 19 or less, it may be a sign that your child's asthma is not controlled as well as it could be. No matter what the score, bring this test to your doctor to talk about your child's results.

Have your child complete these questions.

1. How is your asthma today?

0	1	2	3
Very bad	Bad	Good	Very good

2. How much of a problem is your asthma when you run, exercise or play sports?

0	1	2	3
It's a big problem, I can't do what I want to do	It's a problem and I don't like it	It's a little problem but it's okay.	It's not a problem.

3. Do you cough because of your asthma?

0	1	2	3
Yes, all of the time.	Yes, most of the time.	Yes, some of the time.	No, none of the time

4. Do you wake up during the night because of your asthma?

0	1	2	3
Yes, all of the time.	Yes, most of the time.	Yes, some of the time.	No, none of the time

Please complete the following questions on your own.

5. During the last 4 weeks, how many days did your child have any daytime asthma symptoms?

5	4	3	2	1	0
Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday

6. During the last 4 weeks, how many days did your child wheeze during the day because of asthma?

5	4	3	2	1	0
Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday

7. During the last 4 weeks, how many days did your child wake up during the night because of asthma?

5	4	3	2	1	0
Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday

Statistical Analysis:

Statistical package for social science (IBM-SPSS) version 24 (May 2016) was used for analysis. Data were presented as mean and standard deviation in case of normally distributed data; and median and range in case of not normally distributed data.

RESULTS OF THE STUDY

History & Demographic data of our cases showed that the mean age was nearly 8±2.3 years. Family history of smoking was found in up to 73% of them, Past history of similar attacks was reported in 93% of cases and normal developmental history (94%). (Table 1).

Table (1): History & Demographic data/schedule.

Item		*No.*	*%*
Age (years)	***Mean±SD***	*7.925±2.339*	
	Median(range)	*7(6-22)*	
Sex	***Male***	*47*	*47%*
	Female	*53*	*53%*
Family history	***of similar conditions***	*33*	*33%*
	of smoking	*73*	*73%*
Past history	***of similar attacks***	*93*	*93%*
	of recurrent chest infection	*33*	*33%*
Developmental history	***Normal development***	*94*	*94%*
	Delayed walking	*1*	*1%*
	Delayed teething	*5*	*5%*

Regarding the clinical data, we found that the age at disease onset ranged from 1 month to 9.5 years, with a mean of around 2.5 years. More than half of the cases had intermittent asthma (56%), and another 30% had mild persistent asthma. Moderate and severe asthma were seen in only 8% and 6%; respectively. (Table 2. and figure 1).

Table 2. Clinical data of the study group

Item		**Value**
Age at onset(yrs.)	**Mean±SD**	2.589±1.537
	Median(range)	2(0.1-9.5)
Severity	**Mild persistent asthma**	30(30%)
	Intermittent asthma	56(56%)
	Moderate asthma	8(8%)
	Severe asthma	6(6%)

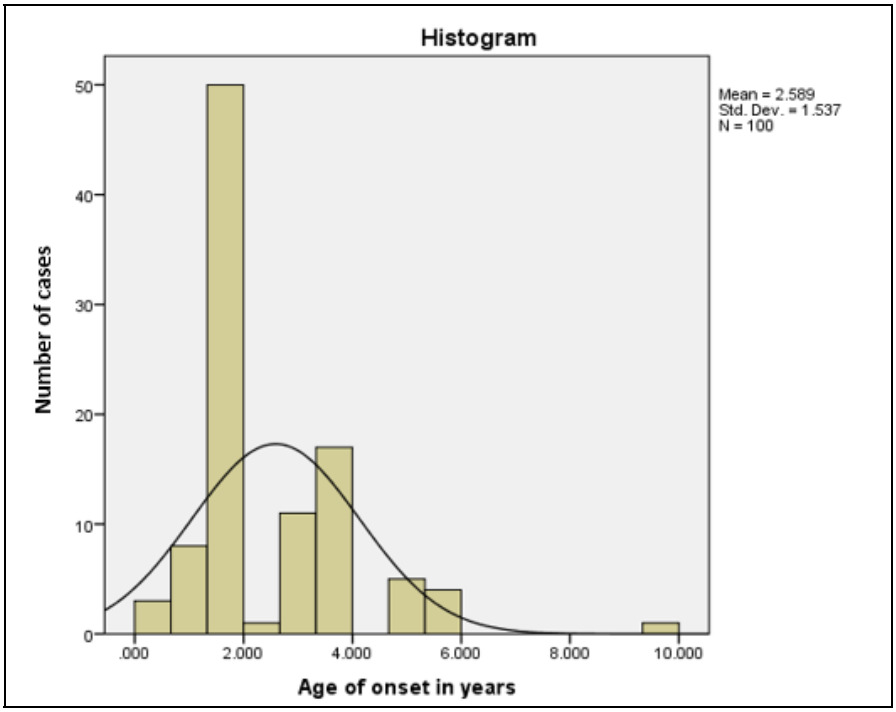

Figure (1):Age of onset of the study group.

The duration of wheezing spells had a very wide range between one day to 28 days. This was reflected in the very high standard deviation (nearly 5) compared to mean (3.63 days). Regarding the triggering factors of wheezing, exercise was the most common cause, followed by dust. Combined causes were seen in 12% of cases (table 3).

Table 3. Clinical data of wheeze in the study group

Item		Value
Duration of wheezing spells in days	**Mean±SD**	3.63±4.94
	Median(range)	2(1-28)
Wheezing triggered by	**Exercise alone**	45(45%)
	Dust alone	30(30%)
	Smoking alone	6(6%)
	Respiratory infection	7(7%)
	Exercise + Dust	5(5%)
	Respiratory infection +smoking + Dust+ Exercise	7(7%)

Allergic manifestations other than wheeze were reported by 69% of cases. Skin allergy was the commonest symptom, seen in 36% of cases, followed by runny nose (30%) and lastly watery eye (3%). (Table 4).

Table (4): Other Allergic Manifestation.

Manifestation	No (%)
Runny nose	30(30%)
Skin allergy	36(36%)
Watery eye	3(3%)
No other allergic manifestations	31(31%)

Steroids were the most common medications given to our study patients, as 56% of patients received steroid (inhaled 44%, oral 4% and oral combined with bronchodilator 6%). This was followed by bronchodilators in 50% of cases (single medication in 44% and combined with steroid in 6%). (Table 5).

Table (5). Medications given to the study population.

	No.	Percent
Inhaled steroid	44	44.0%
Oral steroid	4	4%
Oral B2 agonist	1	1%
Inhaled B2 agonist	1	1%
Oral xanthine's	44	44%
Oral steroid + other bronchodilators	6	6%

Criteria as the 2015 GINA guidelines, an ACT score of >23 and a score <19 indicates well-controlled asthma, and uncontrolled asthma, respectively. A cutoff score of <19 was associated with higher risk of adverse asthma outcomes. Moreover, Regarding ACT and PEFM scores, we found that both increased steadily from the 1st week to the 8th week. This rise is statistically significant from as early as the second week, with highly significant differences (table 6).

Table 6. ACT scores and PEFM progress among all study groups

	ACT			PEFM		
	Mean±SD	t test*	P value	Mean±SD (L/Min.)	t test*	P value
1st week	19.75±4.69	-	-	111.30±30.67	-	-
2nd week	20.84±3.54	4.802	<0.001	122.70±32.44	3.688	<0.001
3rd week	22.21±2.78	6.725	<0.001	133.30±33.00	6.196	<0.001
4th week	23.14±2.66	7.929	<0.001	141.30±37.78	8.001	<0.001
5th week	23.16±2.49	7.957	<0.001	141.80±36.11	8.595	<0.001
6th week	23.58±2.46	8.756	<0.001	144.10±36.30	9.072	<0.001
7th week	24.21±2.48	9.691	<0.001	150.20±37.39	10.686	<0.001
8th week	24.48±2.59	10.071	<0.001	153.80±38.84	11.347	<0.001

* Paired t test was used, comparing the results with the first week as a baseline

With regard to NAEPP EPR-3 guidelines, a score of >20 indicates well-controlled asthma, a score of 16–19 indicates not well-controlled asthma, and a score of<15 indicates very poorly controlled asthma. ACT was significantly better among controlled than uncontrolled patients from the 1st to 6th weeks. On the other hand, PEFM was significantly higher among controlled than uncontrolled patients in the first week only (tables 7 and 8).

Table 7. ACT scores between controlled and uncontrolled patients

	ACT			
	Controlled	Uncontrolled	t test	P value
1st week	23.09±2.28	15.14±2.89	15.369	**<0.001**
2nd week	23.21±1.69	17.57±2.73	12.704	**<0.001**
3rd week	23.28±1.98	20.74±3.06	5.030	**<0.001**
4th week	23.84±2.13	22.17±3.02	3.258	**0.002**
5th week	23.79±1.93	22.29±2.92	3.112	**0.002**
6th week	24.14±1.93	22.81±2.89	2.754	**0.007**
7th week	24.60±2.11	23.67±2.86	1.886	0.062
8th week	24.81±2.14	24.02±3.07	1.510	0.134

Table 8. PEFM between controlled and uncontrolled patients

	PEFM			
	Controlled (L/Min.)	Uncontrolled (L/Min.)	t test	P value
1st week	117.59±29.76	102.62±30.13	2.470	**0.015**
2nd week	126.90±31.30	116.90±33.46	1.531	0.129
3rd week	133.79±35.48	132.62±29.64	0.175	0.862
4th week	139.83±38.59	143.33±37.00	0.456	0.649
5th week	139.83±37.39	144.52±34.51	0.640	0.524
6th week	142.07±37.12	146.90±35.37	0.656	0.514
7th week	148.10±38.82	153.10±35.58	0.657	0.513
8th week	152.59±40.38	155.48±37.04	0.366	0.715

There was a steady increase in the control percentages of cases compared to the first week taken as the baseline; this was statistically significant at the first week only. (Figure 2).

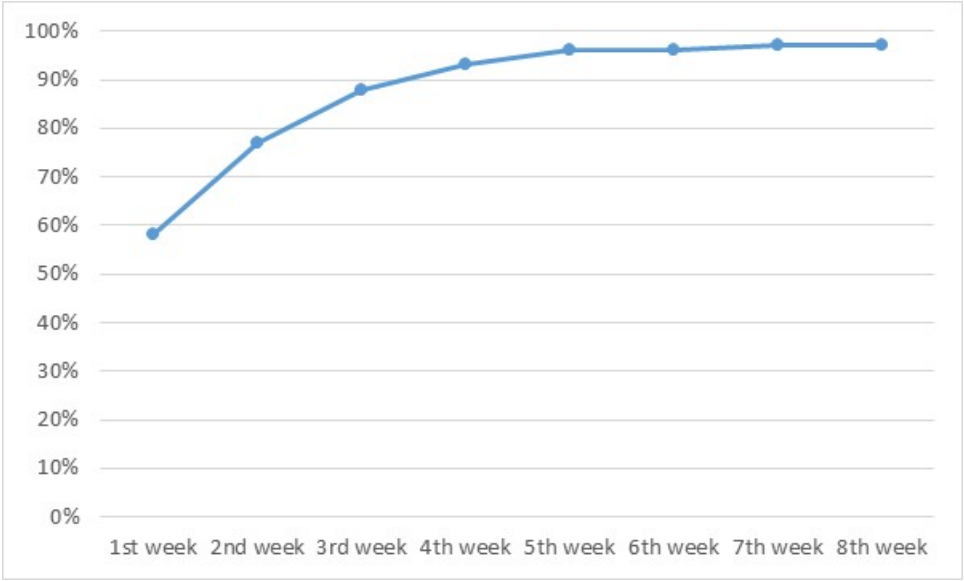

Figure (2): Control of asthma of the study population through the study duration.

DISCUSSION

Asthma is a chronic inflammatory disorder of the airways resulting in episodic airflow obstruction. Chronically inflamed airways are hyper-responsive and airflow is limited by bronchoconstriction, mucus plugs, and inflammatory mucosal edema of the airways. An estimated 300 million people worldwide suffer from asthma, with 250,000 annual deaths attributed to the disease [(2)].

Asthma has a potential adverse effect on the patient and the society in terms of morbidity, quality of life, physical activity, education, socialization and self-esteem, disability-adjusted life years (DALYs) including school absence and health care costs. Hence, early diagnosis and appropriate treatment of asthma is critical to decrease the impacts [(11)].

Currently, the main goal of asthma treatment is to achieve and maintain good asthma control. Asthma control is best assessed using patient-reported outcomes [(12)]. Unfortunately, there are a few validated instruments for use in pediatric populations. Among children of 5–11 years of age, the only measure of asthma control recommended by the 2010 National Institutes of Health (NIH) Asthma Outcomes Workshop is the childhood Asthma Control Test (C-ACT) [(13)].

It is important to evaluate the severity and monitor the level of control regularly and adjust therapy to achieve and maintain clinical control [(14)].

Guidelines from the National Heart, Lung and Blood Institute for the diagnosis and management of asthma, and the Global Initiative for Asthma Control provided an index for evaluation of the severity of asthma and attainment of control to guide initiation and adjustment of therapy. The level of control of the disease was classified into controlled, partly controlled, and uncontrolled disease status, taking into account day-time and nocturnal symptoms, exercise limitation, pulmonary function, beta-2-agonist use, and disease exacerbation and forced expiratory volume in one second (FEV1) [(15)].

This study was carried out to validate the ACT in assessment of level of control in asthmatic children visiting the allergy and pulmonology clinic; Al-Hussein Hospital; Al-Azhar University and the outpatient clinic; Sohag Teaching Hospital, Sohag Governorate, Upper Egypt.

In our study females were slightly more than males (53%).

The mean age was nearly 8±2.3 years.

In our study the family history of similar conditions was seen in one third of cases, while family history of smoking was found in up to 73% of them, it was seen more among uncontrolled patients than controlled ones, with a significant difference. Family history in our cases was much less than that of ***Volovitz et al*** who stated that the family history of their cases was up to 73% [16]. On the other hand, our study showed somewhat different results from the study done by ***Ortiz-Lizcano et al.,*** as they reported family history of smoking in only 53% of their cases [17].

Past history of similar attacks was reported in nearly all of our cases, and past history of recurrent chest infection was found in one third of them. This was similar to the data recorded by ***Volovitz et al*** as they stated that past history of similar attacks were seen in all of their cases and past history of hospitalization due to chest infection was found in 27% of them [16].

The vast majority of cases experienced normal developmental history, with delayed development (walking or teething) found only in 6% of cases. Regarding dietetic history, the majority of cases received mixed milk (breast and complementary milk).

Allergic manifestations other than wheeze were reported by 69% of cases. Skin allergy was the commonest symptom, seen in 36% of cases, followed by runny nose (30%) and lastly watery eye (3%). Our study was similar to that done by ***Bime et al*** as they found that more than 3/4 of their cases had allergic manifestations other than wheeze [18]. This was different from the study done by ***Zhou et al.*** who found in their study that allergic manifestations were seen in only 15% of cases [19].

In our study the age at disease onset ranged from 1 month to 9.5 years, with a mean of around 2.5 years, this was somewhat wider range than that done by ***Rodriguez Martinez et al*** as they reported in their results that age of onset varied from 12 to 24 months [20]. Also, the mean age at onset of cases studied by ***Bime et al*** was 2.9 years and a wide standard deviation of 2.5 years. However, they did not measure the range among their cases [18].

More than half of the cases had intermittent asthma (56%), and another 30% had mild persistent asthma. Moderate and severe asthma were seen in only 8% and 6%; respectively, patients with intermittent symptoms are control-

led more than severe cases, also patients with combined chronic cough and wheeze trends more to be uncontrolled than those with a single manifestation (cough or wheeze). Generally, our cases had milder disease than ***Leung et al*** and ***Ortiz-Lizcano***. The study done by ***Leung et al.*** reported that most of the children had moderate persistent or mild persistent asthma (34% and 32%; respectively) [(21)]. Also, the results of ***Ortiz-Lizcano*** showed that 66% and 30% of their cases had mild persistent and moderate persistent asthma; respectively [(17)].

Steroids were the most common medication given to our study patients; given to more than half of them. This was followed by bronchodilators in 50% of cases. This was somewhat similar to the study done by ***Bime et al*** as they found that steroid use was used by around 3/4 of cases and bronchodilators were used by over two thirds of them [(18)].

In our study we found that both of ACT and PEFM scores increases steadily from the 1st week to the 8th week. This rise is statistically significant from as early as the second week, ACT was significantly better among controlled than uncontrolled patients from the 1st to 6th weeks. On the other hand, PEFM was significantly higher among controlled than uncontrolled patients in the first week only, steady increase in the control percentages of cases compared to the first week taken as the baseline, this was statistically significant from as early as the second week. Our findings confirmed the results published by ***Zhou et al*** who evaluated the usefulness of ACT in children with different levels of control of asthma at enrollment and follow-up visits and found significant positive correlations between ACT and FEV1 which indicated that ACT is a useful test in assessing the level of control in asthmatic children [(19)].

CONCLUSION

This study concluded that asthma control test is a useful and simple method for the evaluation of asthma severity and control among children in Egypt.

RECOMMENDATIONS

1. We should use ACT because it is a useful and valid test in assessing the level of control in asthmatic children.
2. We should use ACT because it is a simple test to use by physicians and family to follow up asthmatic children.

3. We should use PEFM because it is very important for long-term follow up of asthmatic children.

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صلاحية "إختبار التحكم في الربو" في تقييم مستوى السيطرة على الربو في الأطفال

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***قسم الأطفال بكلية الطب جامعة الازهر بالقاهرة**

****مستشفى سوهاج التعليمي**

حتى الآن، في مصر، لم يكن هناك أي إجراء فعال أو من السهل تعريف السيطرة على الربو. تهدف الدراسة الى تقييم صلاحية اختبار التحكم في الربو في تقييم مستوى التحكم في الربو عند الأطفال المترددين على عيادة الحساسية بمستشفى الحسين الجامعي جامعه الازهر بالقاهرة، والمترددين على العيادة الخارجية بمستشفى سوهاج التعليمي محافظه سوهاج صعيد مصر.

أسلوب الدراسة

أجرينا، دراسة وصفية مستقبلية مقارنه، في الفترة من 2016/6 الى 2017/7 على مئة طفل من الجنسين في الفئة العمرية ما بين ستة واثني عشر عاما،

معايير الاختيار:

1- أطفال موثق إصابتهم بالربو
2- السن 6-12 سنه
3- مستويات مختلفة من التحكم في الربو

معايير الاستبعاد:

سوف نستبعد من الدراسة:
1- الأطفال اقل من 6 سنوات
2- الأطفال الذين يعانون من امراض صدر مزمنة غير الربو
3- الأطفال الذين يعانون من أمراض القلب الخلقية والروماتيزمية
4- الأطفال الذين سبق لهم الحجز بالمستشفى في اخر أربع أسابيع

تم تصنيف جميع المريض وفقا للمبادئ التوجيهية جينا (2014) إلى 4 مجموعات فرعية: الربو المتقطع، الخفيف المستمر، المعتدل المستمر والشديد المستمر.

تم تقسيمها الى مجموعتين حسب إذا كان ربو متحكم فيه او ربو غير متحكم فيه، تمت متابعه جميع الحالات باختبار التحكم في الربو ومعدل تدفق الهواء بالرئتين عيادة الحساسية بمستشفى الحسين الجامعي جامعه الازهر بالقاهرة، والمترددين على العيادة الخارجية بمستشفى سوهاج التعليمي محافظه سوهاج. (خلال 8 أسابيع).

النتائج

وكانت نتائج كلا من اختبار التحكم في الربو ومقياس أقصى تدفق للهواء يزداد بثبات من الأسبوع الأول وحتى الأسبوع الثامن. وكان لهذا الارتفاع دلاله إحصائية من الأسبوع الثاني، مما يدل على تحسن كل الحالات التي تم استخدام اختبار التحكم في الربو معها.

وكان اختبار التحكم في الربو أفضل احصائيا في الأطفال الذين يعانون من الربو المنضبط عن الأطفال الذين يعانون من الربو غير المنضبط من الأسبوع الأول وحتى الأسبوع الخامس وعلى الجانب الاخر كانت نتائج مقياس اقصى تدفق للهواء عالية في الأطفال الذين يعانون من الربو المنضبط في الأسبوع الثاني فقط

وأخيرا، هناك زيادة مطردة في نسبة السيطرة على الحالات مقارنه بالأسبوع الأول كبداية للتقييم وهناك دلاله إحصائية على ذلك بداية من الأسبوع الثاني وهذا يثبت صلاحيه اختبار التحكم في الربو في تقييم مستوى الربو.

اختبار التحكم في الربو طريقه سهله ومفيدة في تحديد خطورة الربو وتحديد معيار السيطرة عليه في الأطفال في مصر.

التوصيات:

1- لابد من استخدام اختبار التحكم في الربو لأنه صالح ومفيد في تقييم مستوى التحكم في الربو.
2- لابد من استخدام اختبار التحكم في الربو لأنه اختبار بسيط للاستخدام عن طريق أطباء او عائله الأطفال المصابين بالربو.
3- لابد من استخدام مقياس اقصى تدفق للهواء لأنه مناسب جدا لمتابعه حالات الربو عند الأطفال على المدى البعيد.