

Short communication

Asthma control in children: Is it important and can we measure it?



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SUMMARY

The goal of asthma management is to achieve disease control. Poorly controlled asthma is associated with an increased number of days lost from school, exacerbations and days in hospital. Furthermore, children with uncontrolled asthma have more frequent contacts with the health-care system. Recent studies have added new information about the effects of poorly controlled asthma on a range of important, but less studied outcomes, including risk of obesity, daily physical activity, cardiovascular fitness, stress, concentration and focused attention, learning disabilities and risk of depression. From these studies it seems that poor asthma control may have a greater impact on the child than previously thought. This may have important long-term consequences for the child such as an increased risk of life-style associated diseases and poorer school performance. The level of control seems to be the most important determinant of these adverse effects and improvement in asthma control is associated with improvements in many of the outcomes. However, the improvement has to be maintained for a very long time (> 1 year).

Accurate assessment of the level of asthma control is difficult. Various tools and scores have been developed. They are all based on various questionnaires, but their validation has been difficult because we have no golden standard to compare with. It seems as if the tests are most valuable when they suggest that the disease is poorly controlled because a large proportion of children in whom the tests suggest good asthma control may still have poorly controlled asthma when various objective outcomes are included in the assessment. A main reason for that seems to be that none of the tests accurately detects the child's adaptation in lifestyle. If you do not exercise you have fewer symptoms.

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INTRODUCTION

Several studies have documented the benefits of good asthma control on a variety of outcomes such as reduced health-care resource utilization and loss of work/school days, a higher probability of a normal quality of life, and reduced risk of exacerbations. However, poor asthma control may also be associated with less well-known impacts on children such as increased risk of obesity, reduced daily activity and physical fitness and a negative impact on cognitive and intellectual functions [1].

DAILY ACTIVITY AND PHYSICAL FITNESS

There are significant correlations between daily physical activity and cardiovascular fitness [2]. Moreover, a significant dose-response relationship has been documented between physical activity/cardiovascular fitness and important risk factors for cardiovascular disease [3]. Therefore any increase in daily physical

activity is normally considered beneficial. Although some studies do not find any differences in the daily physical activity or cardiovascular fitness between groups of children with asthma and healthy children several do find significantly reduced levels of physical activity or fitness in children with asthma compared with healthy children [4,5]. The poor characterization of level of asthma control, the treatments used, and even the diagnostic criteria for asthma in most studies preclude an accurate analysis of the reason for this discrepancy. A recent prospective, one year, case control study on well-characterized children found that children with asthma were less fit and ran shorter distances during the exercise tests than their healthy control subjects [6,7]. Within the asthma group, fitness and time spent in intensive daily activity depended significantly on the level of asthma control; children with poorly controlled asthma were less fit and had less intensive daily activity. Moreover, the activity of children with uncontrolled asthma was significantly less than the activity in their healthy control subjects. Similar findings have been reported in younger children.

When the children with asthma were treated, their asthma control improved during the year of treatment [7]. The improvements were associated with significantly greater improvements in

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physical activity in children with asthma than in their healthy control subjects (around 2.5 h per week). Moreover, the increase in activity was associated with a significantly greater increase in cardiovascular fitness in the asthma group (Figure 1). The greatest improvements in activity and fitness were seen in the children with the poorest asthma control at baseline and greatest improvements in control during treatment. So, it seems that uncontrolled asthma adversely affects daily activity and fitness in children and that long-term improvement in asthma control reverse these negative effects of the disease.

ASTHMA AND OBESITY

Cross-sectional studies have consistently found an association between asthma and obesity. The relation is often explained by reverse causality: asthma leads to obesity through a more sedentary lifestyle. However, longitudinal studies have reported that obesity precedes asthma, suggesting that obesity may be a risk factor for asthma development [8]. Since asthma is often under-diagnosed for some years, it cannot be excluded that undiagnosed and uncontrolled asthma may have contributed to less physical activity and an increase in weight gain up until the time the diagnosis. An inverse relationship between physical activity and body fat is seen in healthy children [9]. The correlation has generally been low to moderate, probably because many other factors are linked to obesity. In most studies the criteria for an asthma diagnosis have been quite loose and few assessed the level of asthma control. However, daily physical activity seems to protect against accumulation of body fat and the risk of being overweight decreases with the level physical activity and/or cardiovascular fitness [8].

Studies which included a careful assessment of the level of asthma control found that children with newly diagnosed asthma had a significantly higher BMI and percentage body fat, as well as a higher frequency of obesity than their age and sex matched healthy controls [6,7]. These parameters were also higher in children with uncontrolled asthma than the values measured in children with well-controlled asthma. When treated, asthma became controlled and the annual weight gain became similar to the weight gain in healthy children [7]. These results corroborate the findings in healthy subjects that daily physical activity protects against accumulation of body fat and suggest that improved asthma control allows for improved physical fitness and less risk of obesity.

EDUCATIONAL ATTAINMENT AND COGNITIVE FUNCTION

Several chronic health problems impact educational attainment and cognitive functions [10]. Determining whether asthma adversely affects cognitive function and educational attainment is complex and, not unexpectedly, the conclusions from different studies vary. One reason for these differences is that most studies have not adjusted for other factors that impact on educational attainment and cognitive function, such as socioeconomic status, age/years in school, family composition, ethnicity, sex, skill level at school entry (“readiness”), and absenteeism. Moreover, virtually none of the studies included a thorough assessment of the level of asthma control in the patients studied. However, one prospective study, which adjusted for other potentially important factors, found that entering school with a diagnosis of asthma was a significant predictor of low achievement in reading at 12-month follow-up, independent of high absenteeism [11]. This suggests an increased risk of academic problems among children with asthma compared with healthy children, but the study did not allow any conclusions about the influence of asthma control because that was not measured.

The findings in studies that included some markers of asthma control were more consistent than in studies without any assessment of asthma control. Thus, patients with poorly controlled asthma were more likely to have a learning disability than those with good asthma control [12]. This is in agreement with our own findings (not published). Moreover, night-time awakenings in children with asthma adversely affected school performance [13]. Finally, in adults found psychometric tests assessing focused attention, mental flexibility, concentration, and attention were negatively affected in patients with untreated asthma compared with healthy control subjects [14].

In conclusion, uncontrolled asthma seems to be associated with lower cognitive function and educational attainment. Improved asthma control improves cognitive function and reduces school absenteeism. More studies are needed to evaluate the benefits of good asthma control on educational attainment.

ASSESSING ASTHMA CONTROL

The level of asthma control seems to be the most important determinant of the various adverse effects of the asthma disease and improvements in asthma control are associated with improvements in most of the adverse effects. Therefore, achievement of good asthma control is the main focus of asthma management. The problem is that correct assessment of asthma control is not straightforward. Several studies have found that the assessment of control varies markedly amongst healthcare professionals, as well as patients. Generally physicians as well as patients tend to overestimate the level of asthma control with a subsequent risk of under-treatment [15]. In an attempt to facilitate correct asthma control assessment several simple and easy to use composite asthma control scores have been developed. Since the various tests use the same outcomes (day and night symptoms, limitation of activities and use of rescue medication) it is not unexpected that the results of these tests correlate to some extent with each other and with the GINA definition of asthma control [16]. However, symptoms are subjective and influenced by the children's level of perception and the children's daily activities, including sports and play and social life. Symptoms, limitations of activities and use of rescue medication are not independent variables. Physical activity is one of the most important causes of symptoms and reliever use in children. Therefore, many children with insufficiently controlled asthma avoid strenuous exercise [6,5]. The result is fewer daytime symptoms and less rescue use and an apparently controlled asthma. Many parents (and children) are unaware of such change in lifestyle. Therefore, good objective measures of control that do not depend on these factors would be welcome.

It is not known which cut-off value is optimal in distinguishing between controlled and uncontrolled asthma? An ACT of c-ACT score <20 has become accepted as the level for poor asthma control which requires treatment or treatment changes. However, few studies have assessed whether a C-ACT or ACT score >19 can be used as an indication that the asthma is sufficiently or well controlled. The findings in some studies suggest that this is probably not the case. Thus in a recent study the authors concluded that the best cut-off points for well-controlled asthma were ≥ 22 for the C-ACT and ≥ 23 for the ACT [17]. According to the GINA criteria 20% of their patients were well controlled and 80% were not controlled (41% partly controlled and 39% uncontrolled). In contrast only 29% and 25%, of the children were uncontrolled according to the C-ACT or ACT. Similar differences have been reported in another study [18]: 85% uncontrolled according to GINA criteria (uncontrolled and partly controlled) and only 40% uncontrolled with the ACT/C-ACT tests. So children with uncontrolled asthma according to the GINA criteria may be clinically

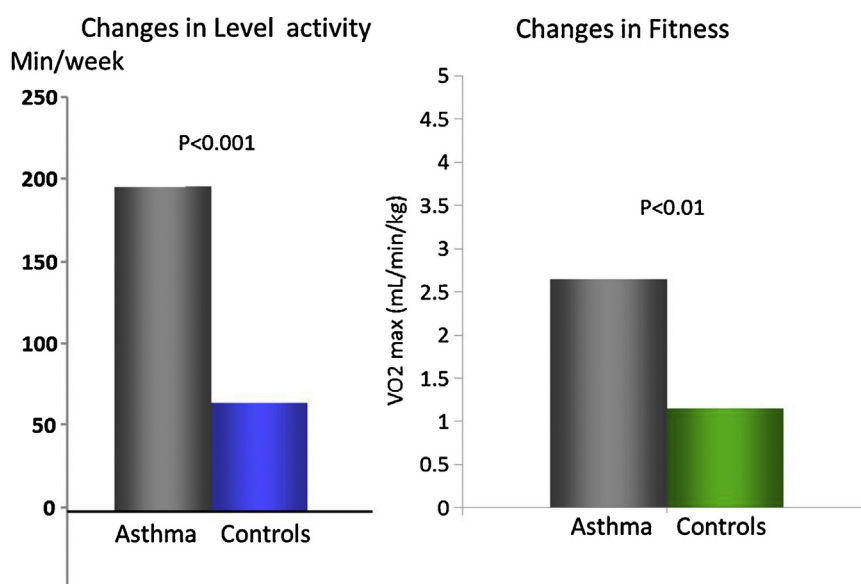


Figure 1. Changes from baseline in daily activity and physical fitness in children with asthma and their age and sex-matched healthy control subjects during 1 year of treatment of patients who had insufficiently controlled asthma at baseline [7].

quite different from children included in studies using a C-ACT or ACT <20 as a criteria to define uncontrolled asthma. The same will be the case for children defined as controlled by these two methods. In agreement with this a study in adults reported that an ACT score > 19 was found not to exclude poor asthma control very well [19].

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