

ORIGINAL ARTICLE

Utility of Exercise Challenge Test in the Diagnosis of Bronchial Asthma in School Age Chil-

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ABSTRACT:

OBJECTIVE: To determine the specificity, sensitivity, tolerance and impact of the Exercise Challenge Test (ECT) on diagnosis of various clinical types of asthma.

MATERIALS AND METHODS:

This cross-sectional study was conducted in the Asthma Clinic, Dept. of Pediatrics, M.P.Shah Medical College and G. G. hospital Jamnagar.

6-12 yrs old children (n=58) diagnosed as mild intermittent asthma (MIA) (n= 39), cough variant asthma (CVA) (n=10), and nocturnal asthma (NA) (n=9) constituted the study group; 40 normal children were enrolled as controls. Those with co-morbidity, severe malnutrition or receiving pharmacotherapy for their asthma were not included. ECT was administered as per the standard recommendations. Follow up of cases was done for one year. Results were statistically analyzed.

RESULTS: ECT had specificity of 97.5%; sensitivity 72% over all and sensitivity in MIA was 72%, CVA 60% and in NA it was 77% when used with PEF. No serious adverse events were noted. 25% subjects had minor - short lasting, self-limiting complications. On follow up, in 64% of available cases, diagnosis was reconfirmed by fresh episodes of documented wheezing and response to bronchodilator therapy.

CONCLUSIONS: ECT is a fairly specific, sensitive, useful and safe test in the diagnosis of bronchial asthma in school age children where available history and/or physical examination are suggestive, but not conclusive. Therefore it can augment early diagnosis and management of asthma including preventive measures.

KEY WORDS: sensitivity, specificity, exercise challenge test, bronchial asthma, mild intermittent asthma. Cough variant asthma, nocturnal asthma.

INTRODUCTION

Asthma is the commonest chronic illness of children. Several studies from different parts of the world have reported increasing prevalence of bronchial asthma.¹ However, a significant number of asthmatics remain undiagnosed or the diagnosis is substantially delayed.^{2, 3}

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This leads to an inappropriate management, increased risk of death, limitation of activity, irreversible damage to airway, and suboptimal performance in sports. Diagnosis is often missed or delayed because of dynamic nature of the disease, technical difficulties in performing the lung function test in young children, Unreliable past history or poor documentation of past episodes,⁴ and lack of specific and sensitive investigations for diagnosis of asthma. Hence there is a need for tools to augment the sensitivity of clinical methods used to diagnose asthma.

It is known that as many as 90% of asthmatic children have EIB (exercise induced bronchospasm).⁵ ECT is simple, safe, inexpensive, consumes very little time, can be performed in clinics and has been recently standardized by the American Thoracic Society⁶ and used as per fixed protocol by other researchers.^{7, 8, 9}

In this background the present study was conceived to evaluate the utility of ECT as an adjunct to history and physical examination to aid in the diagnosis of bronchial asthma in cases where diagnosis was confounded by the above-mentioned factors.

MATERIALS AND METHODS:

This cross-sectional study was conducted over a period of one year from 1st April 2004 to 31st march 2005 at Dept of Pediatrics, M.P.Shah Medical College and the attached G.G.Hospital in Jamnagar which is a coastal town situated in the extreme western part of India with a high prevalence of wheezing in children. For the study, 6 to 12 year old children were included. Cases were recruited from patients in Asthma Clinic, and controls from the visitors of hospitalized patients. 58 cases and 40 controls were studied. Cases were divided into three subgroups: Subgroup A-MIA (n=39), Subgroup B-CVA (n=10) & Subgroup C – NA (n=9)) using standard case definitions (TABLE-1).

For our study only those patient of asthma who had history of only nocturnal symptoms but no day time symptoms were recruited as cases of nocturnal asthma.

Cases with co-morbidity, severe malnutrition, having received pharmacotherapy on the day of inclusion, inability to perform required exercise due to physical /mental disability (such as MR, CP hemiplegia, ataxia) and unsatisfactory effort were excluded. Exercise challenge was given in the form of climbing up and down the 60 steps of standard staircase for 6 minutes, so as to achieve a heart rate of 80-90% upper limit of the normal age.^{6, 7, 8, 9, 13.}

TABLE 1: CASE DEFINITIONS

BRONCHIAL ASTHMA³: Asthma is defined as recurrent wheezing at any age, provided the conditions 1 to 4 outlined below are satisfied. Patient is diagnosed to have asthma if 1) wheeze is present, 2) absence of pulmonary infiltration on X-ray 3) absence of poly morphonuclear leukocytosis or bandamia on peripheral smear (polymorphic response defined as more than 70% polymorph nuclear leukocytosis and >10% band cell as bandamia) and 4) rapid clinical improvement on bronchodilator therapy without antibiotics

MILD INTERMITTENT ASTHMA¹⁰: Symptoms less than once a week, brief exacerbations, Nocturnal symptoms not more than twice a month, FEV₁ or PEF >= 80% predicted, PEF or FEV₁ variability < 20%

COUGH VARIANT ASTHMA¹¹: Cough variant asthma is a form of asthma in which the patient's main respiratory complaint is cough, there is minimal or no wheezing or dyspnea, physical examination is unremarkable, spirometry is normal or nearly normal and in which the patient's cough resolves with treatment of asthma.

NOCTURNAL ASTHMA¹²: Nocturnal Asthma is defined as a variable nighttime exacerbation of under lying asthma condition associated with increase in symptoms and need for medication, increase airway responsiveness and/or worsening of airway function. Generally, reduction in peak flow or FEV₁ of at least 20% is implicit in this definition as exacerbation of asthma at night.¹²

PEFR was recorded, using Mini Wright Peak flow meter, after initial training and achievement of satisfactory performance, before initiation of exercise and post exercise at 1, 3, 5, 10, and 30 min. The same instrument was used for both cases and controls. PEFR was recorded using standard method.¹⁴ Recommended safety measure were observed and post exercise, the subject were evaluated for major (physical discomfort, rapid shallow breathing, use of accessory muscle of respiration with severe wheezing, chest pain, cyanosis, pallor, anxiety, irritability, and non communicative attitude) and minor (cough and wheeze in absence of breathless ness) adverse events.¹⁵

Fall in PEFR >10% from base line and/or cough and/or wheezing was considered positive test. The protocol for exercise challenge test was derived from recommendation of American Thoracic Society⁶, British thoracic society and Roy S.^{7, 8, 9} ECT was given to all cases and controls only once.

RESULTS:

Mean age of cases were 8.5 years and controls were 8.6 years. Male and Female Ratio was 1.5:1. Results of the ECT test are depicted in Table 2. Overall sensitivity was 72% with specificity of 97.5%.

No adverse event was found in any control. 25% of cases developed 'mild' adverse events i.e. cough and/or auscultable wheeze, all of which recovered spontaneously within the observation period. No serious adverse event was detected.

In one year follow-up, 38 cases presented with wheezing which was reversed promptly by bronchodilator administration, and thus diagnosis of asthma was further confirmed in them. Of these, 64% had tested positive in ECT. None of the controls presented with wheezing.

TABLE 2- RESULTS OF EXERCISE CHALLENGE TEST

| | +VE TEST Fall From Base | -VE TEST | MEAN PEFR Line (%) | Sensitivity |
|---------------|----------------------------------|----------|--------------------------|-------------|
| MIA | 29 | 10 | 13.97 | 74.5% |
| CVA | 6 | 4 | 10.26 | 60 % |
| NA | 7 | 2 | 17.33 | 77 % |
| ALL CASES | 42 | 16 | 13.84 | |
| CONT- ROLS | 1 | 40 | 2.96 | |

DISCUSSION:

The result of our study indicate that ECT can contribute to the diagnosis of asthma in more than half of the cases, if these finding are extrapolated in to the situation where diagnosis is elusive due to suggestive but inconclusive history and clinical finding, ECT can have a considerable impact on the diagnosis and management of asthma by early detection in 62% or more cases and therefore timely initiation of appropriate management in many cases, and there by on the overall morbidity. ECT has been found to be very sensitive for diagnosis of bronchial asthma as is evident from the work of other researchers^{2,6,7}. These studies have uniformly reported a high specificity of exercise challenge, which is also reflected in our finding. However, the reported sensitivity is quite varied which may be because of difference in case selection, type and duration of exercise given and difference in the cut-off point of PEFR/FEV₁ used to define 'positive' exercise challenge. We found remarkably higher sensitivity than the above studies, probably because

the test protocol administered for our study was derived from standardized protocol recommended by reputed professional organization.^{17,18,19,20}

CONCLUSIONS:

ECT is a fairly specific, sensitive and safe test for the diagnosis of bronchial asthma in school-age children where available history/physical examination is suggestive but not conclusive particularly when use with PEFR.

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