ORIGINAL ARTICLE

Seasonal Changes and Children with Bronchial Asthma (2—15 Years Age) Reporting at Asthma Clinics of Mayo Hospital and Children Hospital, Lahore

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ABSTRACT

Background: Bronchial Asthma is among the common chronic illnesses of childhood and one of major causes of absence from school. It is a multi-factorial condition determined by an interaction of genetic and environmental factors.

Objective: To document the change in frequency with change in season of bronchial asthma cases (2-15 years) presenting at two tertiary care hospitals in Lahore and advise parents to take preventive measures.

Methodology: A cross-sectional descriptive study was carried out for a period of one year (2002-03) at Mayo Hospital and Children Hospital & Institute of Child Health Lahore. Cases of asthma attending asthma clinics of both hospitals were included in the study. Both seasonal factors (monthly mean temperature & relative humidity of the environment) and outdoor air pollutants were studied for finding out such association.

Result: Out of all asthma cases (n=1135) of both hospitals, reported during the study period, 70.1% had age of 5 to 15 years with male to female ratio 2:1. Maximum cases (n=173) reported in October and minimum (n=42) in February, corresponding with variations in temperature, relative humidity and air pollutants.

Conclusion: More cases visited asthma clinic during hot and humid as well as colder and dry months with higher levels of air pollutants. Parents are advised to take preventive measures to avoid precipitation of bronchial asthma during these months of calendar year.

Key Words: Seasonal Factors, Air Pollutants, Bronchial Asthma, Children

INTRODUCTION

Bronchial asthma is a disease syndrome with its increasing prevalence seen globally, more so, in industrialized countries and particularly in children since last two decades.[1,2] Although precise reasons for such increase are unknown, it is likely that a number of environmental factors are partly responsible.[3] Urbanization along with industrialization has led to persistence of air pollution in urban areas.[4] In Pakistan, rural-urban migration has already become an explosive issue.[5] Lahore is also among the most polluted cities of the world.[5] Bronchial asthma is the common chronic illness of childhood and considered among the major causes of children's absence from school.[2] The condition is a multi-factorial, determined by an interaction of genetic and environmental factors, and is characterized by an airways hyper-responsiveness (AHD) to provocative exposures.[6] Respiratory exposures in this causal environment include inhaled allergens (dust, mite, and pollens), respiratory viral infections, biological and chemical air pollutants.[6] The incriminating urban factors also include parasitic infestations, changes in weather, cigarette smoke, drugs, emotional stress and exercise.[4,7] Among the air pollutants, Carbon dioxide (CO_2), Carbon monoxide (CO), Sulphur dioxide (SO_2), Hydrogen disulfide (H_2S), Oxides of Nitrogen (NOx), Ammonia (NH_3), Ozone (O_3), Smoke and Total Suspended Particles (TSP) or Particulate Matter (PM) are more important.[4] More recently, studies of asthmatic individuals exposed to O_3, NO_2, combination of NO_2 and SO_2 indicated that these agents increased the airway responsiveness of these individuals to inhaled allergens.[8] Cold dry air and strong odors can trigger broncho-constriction when airways are

irritated.[6] Low monthly average minimum day temperature was associated with high prevalence of upper and lower respiratory tract infections.[9] Moreover global warming will have effects on human health, many of them being adverse. Children will experience both the direct and indirect effects of climate change.[10] The major sources of air pollution in Lahore are by-products of fuel combustion from vehicles and emissions from stationary industrial sources.[11] It was estimated in November 2002 that areas comprising of Lahore Metropolitan Corporation had 0.02 ppb of SO_2, 0.29 ppb of NO_x, 0.11 ppb of NO, 0.01 ppb of O_3, 4 ppm of CO, 456 µg/m^3 of TSP and all these were mostly discharged from automobile sources.[11]

A descriptive study was planned to document pattern of bronchial asthma in children aged 2-15 years with change in season and local urban environment in Lahore. The information would be used to create awareness among community regarding preventive measures..

MATERIAL AND METHODS

The descriptive study was carried out in the pediatrics asthma clinics of Mayo Hospital and Children Hospital, on new and known cases residing in the urban areas of Lahore during the study period (1st April 2002 to 31st March 2003). Diagnosis was made on clinical basis and all the cases fulfilled the selection criteria. The selection criteria comprised of diagnosed asthma patients residing in the urban areas of Lahore, having age of 2 to 15 years by 1st April 2002, and the clinical condition being settled after acute exacerbation. Asthmatic children suffering from other chronic lung diseases (cystic fibrosis, broncho-pulmonary dysplasia, bronchiolitis, pneumonia and emphysema), upper respiratory infections and concurrent cardiac disease were excluded from study population. Purposive sampling technique was used to select the cases.

Data Collection

Data related to study variables of subjects (age, address, family history, duration, indoor risk factors like tobacco smoke in home, smoke, flowers, pets, carpet, use of perfumes in home, clinical features of upper respiratory infections, atopy, drug intake and concurrent disease) were recorded on the pre-tested proforma. Data regarding the seasonal factors (monthly mean temperature in ^{o} C and monthly mean relative humidity in %) and levels of air pollutants for the specific months of year 2002-03 were obtained from the records of Meteorological Department of Pakistan (Lahore Observatory) and Environmental Protection Department, Lahore, respectively. Air pollutants included SO_2, NOx, O_3, NO, all measured in part per billion (ppb), TSP in microgram per cubic meter (µg/m^3) and CO in part per million (ppm). Total asthma cases of study were estimated and the percentage of cases for each specific month was calculated. Distribution of patients was described separately on sex and age basis for each hospital. The data about air pollution and seasonal factors are shown in tables and linear graphs.

RESULTS

A total number of 69.7% patients (n=1135) of 2—15 years age were diagnosed as asthma cases at Asthma Clinics of Mayo Hospital and Children Hospital during the study period. 70.1% children (n =796) had age of 5—15 years while 29.9% children (n=339) had age less than 5 years. Male patients (n=741) were predominant as 65.3% while females cases (n=394) were 34.7% with 2:1 ratio.

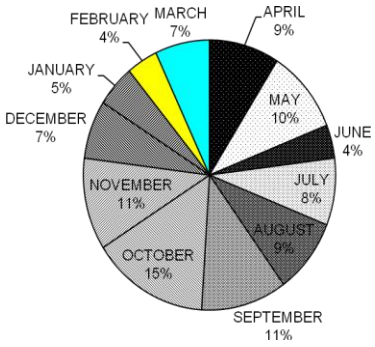

Figure 1: Percentage of outpatient asthma cases per month reporting in two teaching hospitals of Lahore (2002-03)

The number of asthma cases varied in the different months of year. Maximum number of bronchial asthma cases (n=173) were found in month of October (15%) and minimum cases (n=42) in month of February (4%) as shown in Figure 1. Family history of atopy was present in 15% of cases (n=170). The major indoor air pollutant was tobacco smoking in the house, and the most common finding was that smoker was father of the child (Figure 2). In relation to seasonal factors, numbers of cases were proportionately

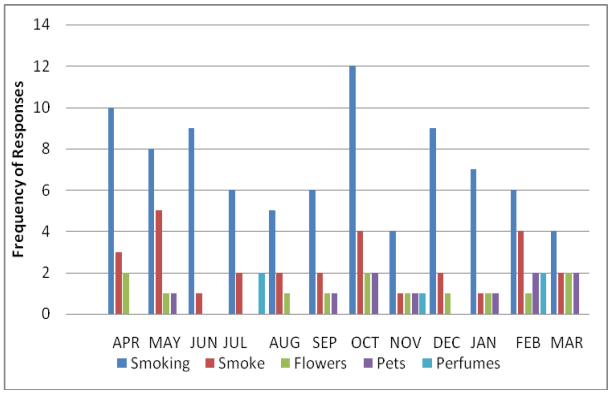

Figure 2: Monthly variation of responses about exposure of selected indoor pollutants asked from outpatient asthma cases at two teaching hospitals of Lahore (2002-03)

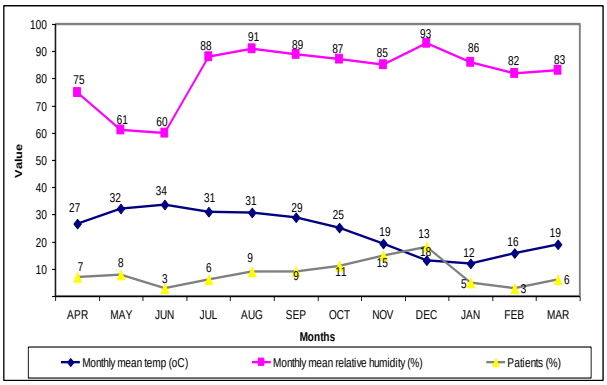

Figure 3: Frequency of outpatient asthma cases, monthly mean temperature and monthly mean relative humidity of Lahore (2002-03)

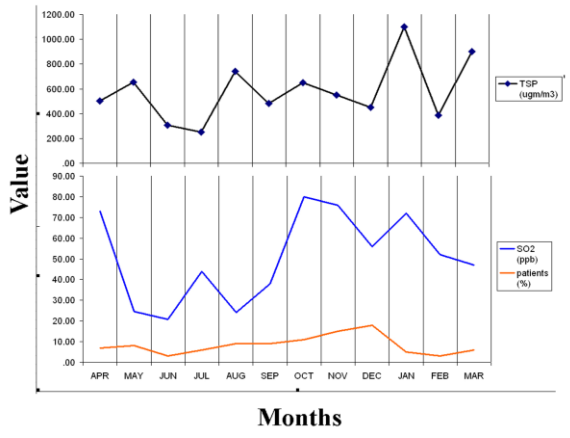

Figure 4: Frequency of outpatient asthma cases reporting at two teaching hospitals and monthly outdoor air pollutants levels of Lahore (2002-03).

more in the months of July to December, corresponding with relatively high humidity and lowering temperature (Figure 3). Numbers of cases were proportionately more in months of July to December, corresponding with higher value of SO_2 in October (80 ppb, with mean ± sd of 38.13±28.52 ppb) and TSP in January (1100 µgm/m^3) (Figure 4).

DISCUSSION

70.1% children suffering from asthma had ages from 5—15 years in the study and this could be due to defined unequal class intervals. The male predominance in the cases could be due to reason that boys have lower expiratory flow rate at all comparable lung volumes in comparison to girls. This functional difference disappears during late puberty when all measures of lung functions in boys accelerate to reach their adult values.[6] Another important factor may be the gender-based health seeking behavior. Rest of the findings was observed for both sexes and both age groups (below 5 years, and above). In the study, family history of atopy was present in 15% cases only. Out of all indoor pollutants studied, the major indoor pollutant was tobacco smoking in the house. However, other researcher reported a number of indoor pollutants to be responsible for increased asthma attacks e.g. carpets, pets, tobacco smoking and smoke were found in the environment of 77% children.[7] The other risk factors included exposure to cold weather in 15.4% patients and dust in 12.3% cases. In these children 47.7 % of children had also family history of atopy.[7] Similarly on meta-analysis pneumonia risk in young children is observed to be increased by exposure to unprocessed solid fuels by a factor of 1.8.[12] Air pollutants aggravate asthma attacks either by directly adhering to the surface of biological airborne allergenic agents, modifying their antigenic properties or by indirectly influencing this interaction.[8] Moreover, airway mucosal damage and impaired muco-ciliary clearance induced by air pollution may facilitate the penetration and access of inhaled allergens to cells of immune system, so promoting airway sensitization accounting for increasing prevalence of allergic respiratory diseases in urban areas.[8] The current study revealed that more cases of asthma reported in months of July to December while less number of cases visited outpatients departments in months of January to June. The months showing increased number of asthmatic

attacks corresponded to the changes in mean temperature and relative humidity A similar association was also found with those days when temperature and humidity were at the lowest.[9] Similar finding was also reported by a researcher, mentioning that air pollutants can interact with aeroallergens in the atmosphere and/or on human airways, potentiating their effects.[13] Exposure to outdoor air pollutants primarily leads to increased exacerbations, sometimes manifested as asthma clusters. Clinicians should be alert for space-time clusters of asthma exacerbations in the community because these clusters may suggest a modifiable point-source exposure.[14] It might be due to the reason that in the dry season, the airway of human beings became hyper-responsive to allergens.[6] In the present study, numbers of asthmatics were more in those months having high TSP, SO_2, NO and CO levels whereas less number of cases were reported in the months in which the recorded level were minimum. Similarly in a study on 4,907 children, asthma (exercise induced, past year and lifetime) was significantly positively associated with benzene, SO2, particles with 50% cut-off aerodynamic diameter of 10 mm (PM10), Nitrogen oxides (NO) and CO. Accurately modeled urban air pollution was associated with some measures of childhood asthma and allergies.[15] The present study was conducted for only one year to document seasonal trends of a disease a multicentre study for more two years should be carried out. Further, it is suggested that a case control study may be conducted to document impact of risk factors in a disease like bronchial asthma.

CONCLUSIONS

More asthma cases reported to outpatients department of both hospitals during hot and humid as well as in cold and dry months of the year which had higher levels of air pollutants. However, the precise delineation of the effects of air pollution on bronchial asthma in children of 2-15 years age further studies should be conducted.

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REFERENCES

1. Ranabir Pal, Sanjay Dahal, Shrayan Pal. Prevalence of bronchial asthma in Indian children. Indian J Community Med [serial online] 2009 [cited 2010 Oct 13]; 34:310-6. Available from: http://www.ijcm.org.in/text.asp?2009/34/4/310/58389
2. Al-Frayh AR , Shakoor Z, Gad –El-Rab MO, Hasnain SM. Increased prevalence of asthma in Saudia Arabia. Ann Allergy Asthma Immunol 2001;86(3):292-6.
3. Panagiotis T Nastos, Athanasios G Paliatsos, Michael B Anthracopoulos, Eleftheria S Roma and Kostas N Priftis. Outdoor particulate matter and childhood asthma admissions in Athens, Greece: a time-series study. Environmental Health 2010, 9:45[cited 2010 Oct 13]. Available from http://www.ehjournal.net/content/9/1/45
4. New Bonay M, Aubier M. Air pollution and allergic airway diseases. Med Sci (Paris) [Article in French] 2007 Feb;23(2):187-92.
5. Iliyas M, Burney MI, Taqi L. Environmental Hazards. Iliyas M, editor. Public Health & Community Medicine.7th ed. Karachi: Time Publisher; 2006:223-37.
6. Liu AH, Covar RA, Spahn JD, Leung DYM. Childhood Asthma. Kliegman RM, Behrman RE, Jenson HB, Stanton BF editors, Nelson Textbook of Pediatrics. 18th ed. Philadelphia: Saunders-Elsevier, 2007:953.
7. Mubashar Y, Hussain W, Maqbool S. Distribution of risk factors in children with bronchial hyper-reactivity. Pakistan Pediatr J 1999;24(2):61-4.
8. G D'Amato G. Liccardi, M. D'Amato, M. Cazzola. Outdoor air pollution, climatic changes and allergic bronchial asthma. ERJ Sep 01, 2002 vol. 20 no. 3 763-776. Available from: erj.ersjournals.com/content/20/3/763.full
9. ErlingV, Jalil F, Hanson LA, Zaman S. The impact of climate on the prevalence of respiratory tract infection in early childhood in Lahore, Pakistan. J Public Health Med 1999; 21(3): 331-9.
10. Shea KM. Global climate change and children's health. Pediatrics. 2007 Nov;120(5):e1359-67. Epub 2007 Oct 29.
11. Environmental Protection Department. Management of Air Pollution in Punjab. EPD: Lahore, 2003.
12. Mukesh Dherani, Daniel Pope, Maya Mascarenhas, Kirk R Smith, Martin Weber, Nigel Bruce. Indoor air pollution from unprocessed solid fuel use and pneumonia risk in children aged under five years: a systematic

review and meta-analysis. Bulletin of theWorld Health Organization: Geneva, May; 2008:321-416.
13. D'Amato G, Liccardi G, D'Amato M. Environmental risk factors (outdoor air pollution and climatic changes) and increased trend of respiratory allergy. J Investig Allergol Clin Immunol 2000;10(3):123-8.
14. Etzel RA. How environmental exposures influence the development and exacerbation of asthma. Pediatrics. 2003 Jul;112(1 Pt 2):233-9.
15. C. Pénard-Morand, C. Raherison, D. Charpin, C. Kopferschmitt, F. Lavaud, D. Caillaud, *et al*. Long-term exposure to close-proximity air pollution and asthma and allergies in urban children Eur Respir J 2010 [cited July 1, 2010]**;** 36:33-40