

Incidence of Asthma in Children in Tuzla Canton – Bosnia and Herzegovina

Amela Pašić, Husref Tahirović and Mensur Hadžibeganović

Tuzla University Clinical Center, Department of Pediatrics, Tuzla, Bosnia and Herzegovina

ABSTRACT

Asthma is one of the most common chronic diseases whose incidence shows constant growth in childhood. The objective of this work was to look into asthma incidence in children in relation to their age group and sex in a retrospective study, at Tuzla Canton area. The study comprised children of both sexes, age 0–14 who fell sick with asthma within the period from January 1st 2003 to December 31st 2007. The overall incidence and the incidence in relation to age group and sex was calculated as the number of children suffering from asthma, within the age group 0–14 years per 1000 children of the same age group in the Tuzla Canton. Asthma was diagnosed in 277 children (66.1% male and 33.9% female). The difference between asthma frequency in boys and girls was significant ($\chi^2=56.16$; $df=1$; $p<0.0001$). The average difference in proportion between the boys and girls was 32.2% (95% CI=24.32–40.08). From this sample group the boys had a 3.8 times greater risk (OR=3.79; %95 CI=2.67–5.39) of contracting asthma. The average rate of incidence of asthma for both sexes in the observed period was 0.67/1000 (95% CI; 0.6–0.7; for boys 0.86/1000; for girls 0.47/1000). There was a statistically significantly higher incidence of asthma in boys in relation to girls ($t=6.3836$, $df=32$; $p<0.0001$). The epidemiological data obtained could be useful for early detection and adequate treatment of children with asthma in the mentioned area.

Key words: asthma, children, incidence, Tuzla canton

Introduction

Asthma is one of the most common chronic diseases whose incidence and prevalence in childhood and adulthood is showing constant growth in almost all countries around the world. It is estimated that almost 300 million people all over the world suffer from asthma (15% of them are children). In the USA about 17 million of the population (6.4%) suffer from asthma, and of that number almost 5 million are children younger than 18¹. Asthma is the most common reason for missing school in the USA. It is also the most common reason for seeking urgent medical help and hospitalisation. Within the period from 1980 to 1993 the rate of mortality from asthma doubled². In many European countries in 1970–1990 asthma prevalence in children increased by more than 200%³.

Asthma is a pressing problem because financial allocations for asthma management are significant. For example, in the USA public-health allocations for asthma are around 6 billion dollars. This disease might appear at any age but it appears most frequently in childhood. In 50% of cases it appears before the 10th year of life and in puberty it is twice as common in boys than in girls. Later, these differences are lost, and it is more common in adult

women⁴. The reason for the higher asthma risk at an early age is due to the physiological narrower upper respiratory tract with intensified muscular system tonus and higher level of serum IgE⁵, so boys are predisposed for deterioration of limited air flow as a response to various stimuli. The incidence of asthma is greater in prepubertal boys than girls, but in adolescence this difference becomes less. The fact that the sex-specific difference emerges at about 11 years of age, the average age of transition from Tanner stage 1 to Tanner stage 2, may speak directly to potential mechanisms⁶. Several research have evaluated airway responsiveness in subjects at pre- and postpubertal time points, noting in each case that females demonstrated significantly greater responsiveness than males after puberty, but not before^{7,8,9}. Mechanistically, these differences may be potentially explained hormonal changes. Therefore, the transition period between childhood and adulthood may indicate a time in which females become more susceptible to airway responsiveness.

Although research has showed that in the USA the number of hospitalisation and rate of mortality are three

times higher than in Afro-Americans, the racial and ethnic variations of suffering from asthma are less obvious with persons living in the same area, which implies that it is probably the consequence of environmental factors rather than racial predisposition^{10,11}. The objective of this study was to determine the asthma incidence in children through a retrospective study in relation to their age group and sex in the Tuzla Canton area within the period from 1 January 2003 to 31 December 2007.

Patients and Methods

Geographical position of the research site

Tuzla Canton area is an administrative unit of the Federation of Bosnia and Herzegovina. It is situated in the north-east part of Bosnia and Herzegovina covering an area of 2649 km² with a population of 496 380 in 2007, including 89 118 children aged 0–14⁹.

Subjects

The study comprised children of both sexes aged 0–14 years diagnosed with asthma in the period from 1st January 2003 to 31st December 2007. The main source of data were the medical records of the Division and Outpatient Division for Pulmology at the Department of Pediatrics in Tuzla. Secondary independent sources were data on the children who fell sick with asthma in the 0–14 age group registered in health centre medical documentation in all 13 municipalities in the Tuzla Canton area (TC). In relation to age group the subjects were divided into the following groups: 0 to 4.9 years age group, 5 to 9.9 years and 10 to 14 year age group.

Population data about children from the 0–14 age group for both sexes in the Tuzla Canton area in the relevant period were obtained from the Federal Registry Office in Sarajevo.

Methods

In a retrospective study, the medical documentation was analyzed from the Department of Pediatrics and Health Centre patients in the TC area. The diagnosis of asthma was made on the basis of the Global Initiative for Asthma criteria (GINA)¹².

Statistical analysis

The total incidence rate, and the incidence in relation to age and sex was calculated for the period 2003–2007, as the number of those with asthma within the 0–14 age group from 1000 children of the same age group in the Tuzla Canton area. For testing the statistical significance of the differences between the samples, parametric and nonparametric tests of significance were used (ANOVA (with Bonferroni test), Kruskal-Wallis test (multiple testing), proportion test and χ^2). Statistical hypothesis was tested at the level of significance of $\alpha=0.05$, the difference among samples would be considered significant if $p<0.05$. The data were analyzed with the Arcus Quick Stat statistical programme¹³.

Results

In the Tuzla Canton area within the period from 1st January 2003 to 31st December 2007, the diagnosis of asthma in the 0–14 year age group was made in 277 children (183 or 66.1% males and 94 or 33.9% females). The frequency of asthma in relation to the examined age group and sex is shown in Table 1.

The significant difference in overall asthma incidence among boys and girls is evident ($\chi^2=56.16$; $df=1$; $p<0.0001$). The average proportion difference among boys and girls was 32.2% (%CI=24.32–40.08). On the basis of the data from this sample, boys had 3.8 times greater chance of suffering from asthma (OR=3.79; %95 CI=2.67–5.39) than girls.

The distribution of children suffering from asthma in the 0–14 age group by years, in the period 1 January 2003 to 31 December 2007 is shown in a linear trend in Table 2 and Figure 1.

Observing the overall distribution of children suffering from asthma *per* year in the relevant period according to sex, it is evident that the highest number of patients was in 2005. Then there were 68 sick children, which included 41 boys and 27 girls. The smallest number was in 2007 (44 children), 31 boys and 13 girls. The line showing the linear trend in the observed period implies that a mild decrease of asthma frequency might be expected in future.

TABLE 1
ASTHMA INCIDENCE IN RELATION TO AGE GROUP AND SEX

| Age group | Number of patients with asthma | | | | | |
|----------------|--------------------------------|------|-------|------|------|------|
| | Total | | Girls | | Boys | |
| | N | % | N | % | N | % |
| 0 to 4.9 years | 45 | 16.2 | 9 | 20.0 | 36 | 80.0 |
| 5 to 9.9 years | 140 | 50.5 | 51 | 36.4 | 89 | 63.6 |
| 10 to 14 years | 92 | 33.2 | 34 | 37.0 | 58 | 63.0 |
| Total | 277 | 100 | 94* | 33.9 | 183 | 66.1 |

* $p<0.001$ in comparison to boys

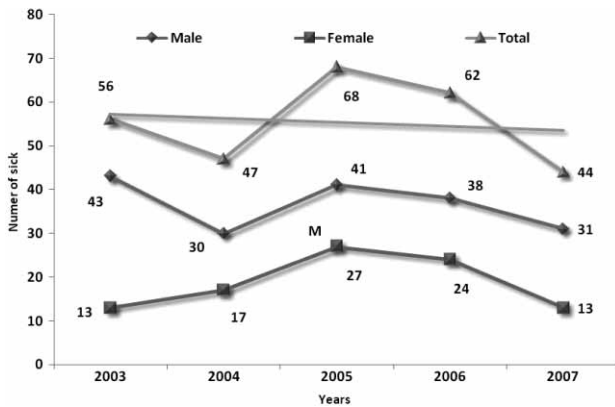


Fig. 1. Trend of annual asthma incidence by sex 2003–2007.

The average annual asthma incidence in the 0–14 year old children age group, in relation to their age and sex within the period from 1st January 2003 and 31st December 2007 is shown in Table 3.

The average incidence of asthma in the period observed for both sexes was 0.67/1000 (95% CI; 0.6–0.7). In relation to the age groups, for both sexes the highest average incidence was in the middle age group 0.98/1000

(95% CI; 0.8/1.1) and the lowest was in the younger age group 0.36/1000 (95% CI; 0.3–0.5). The average incidence of asthma in boys was 0.86/1000. The highest incidence was in the middle age group (1.2/1000) then in the oldest group (0.77/1000) and the lowest was in the youngest age group (0.57/1000). The average incidence of asthma in girls was 0.47/1000. The highest incidence was in the middle age group (0.74/1000) and lowest was in youngest age group (0.15/1000). Altogether, there was a significantly greater incidence in boys than in girls ($t=6.3836$; $df=32$; $p<0.0001$).

Discussion

In the TC area within the period from 1 January 2003 to 31 December 2007 asthma was diagnosed in 277 children aged 0–14 years (66.1% males and 33.9% females). Out of that number, most of them (50.2%) were from the middle age group and the least were from the youngest age group (16.2%). It is known that there are difficulties in defining and differentiating forms of wheezing in the younger age group¹⁴. Although in more than 80% of cases asthma starts in early childhood, before 6 years of age, the diagnosis of asthma in this age group age is not made frequently enough. The reason for this is the shortage of objective tests that might be helpful in diagnosis and dif-

TABLE 2
DISTRIBUTION OF CHILDREN BY SEX WITHIN THE PERIOD FROM JANUARY 1ST, 2003 TO DECEMBER 31ST, 2007

| Year | Number with asthma / % total | | | | Total | |
|-------|------------------------------|------|--------|------|-------|-----|
| | Male | | Female | | N | % |
| | N | % | N | % | | |
| 2003 | 43 | 76.8 | 13 | 23.2 | 56 | 100 |
| 2004 | 30 | 63.8 | 17 | 36.2 | 47 | 100 |
| 2005 | 41 | 60.3 | 27 | 39.7 | 68 | 100 |
| 2006 | 38 | 61.3 | 24 | 38.7 | 62 | 100 |
| 2007 | 31 | 70.4 | 13 | 29.6 | 44 | 100 |
| Total | 183 | 66.1 | 94 | 33.9 | 277 | 100 |

TABLE 3
AVERAGE ANNUAL INCIDENCE OF ASTHMA BY AGE AND SEX FROM 1 JANUARY 2003 TO 31 DECEMBER 2007

| Age group (years) | Boys | | | Girls | | | Total | | |
|-------------------|------------|-------------------------|---------------------|------------|-------------------------|---------------------|------------|-------------------------|---------------------|
| | Asthma (n) | Baseline population (n) | Incidence* (95% CI) | Asthma (n) | Baseline population (n) | Incidence* (95% CI) | Asthma (n) | Baseline population (n) | Incidence* (95% CI) |
| 0 to 4.9 | 36 | 63351 | 0.57 (0.4–0.8) | 9 | 60075 | 0.15 (0.06–0.3) | 45 | 123426 | 0.36 (0.3–0.5) |
| 5 to 9.9 | 89 | 73650 | 1.20 (1.0–1.5) | 51 | 69113 | 0.74 (0.5–0.9) | 140 | 142763 | 0.98 (0.8–1.1) |
| 10 to 14 | 58 | 75334 | 0.77 (0.6–1.0) | 34 | 70331 | 0.48 (0.3–0.7) | 92 | 145665 | 0.63 (0.6–0.8) |
| Total | 183 | 212335 | 0.86 (0.7–1.0) | 94 | 199519 | 0.47 (0.4–0.6) | 277 | 411854 | 0.67 (0.6–0.7) |

* Rate per 1000

ferentiating various forms of wheezing in children of that age.

Besides asthma, wheezing can be caused by other pathological conditions which differ in terms of pathophysiology, risk factors, prognosis and treatment. About 50% of children have at least one episode of whistling (screeching) in the first six years of life, 20% of them have transitory, so called early wheezing which appears before the third year of life, 15% of them have later wheezing after the third year of life and 14% have wheezing throughout the period of the first six years of life¹⁴. This implies that most children have transitory condition which ends during pre-school and at early school age and a smaller number of children have a tendency towards asthma. Wheezing appearing after 18 months of life is strongly connected with atopy and the response of the upper respiratory tract. This implies that environmental factors cause atopic wheezing in early childhood.

Taking into consideration all the above, physicians often postpone making a diagnosis of asthma – besides clear criteria, they are afraid of making mistakes and stigmatization children of a younger age with the diagnosis of asthma. Besides difficulties that physicians face in diagnosing and treating these children, it is very important to make a thorough pulmonary diagnostic analysis in children with repeated wheezing and undertake complete pulmonary diagnostic analysis in order to choose the appropriate treatment strategy, since a process of structural changes is present before the clinical symptoms of asthma become evident.

In all the age groups covered by our research, asthma was more commonly diagnosed in males than in females. This was particularly noticeable in the younger age group, which is in accordance with studies of other authors⁴. Those differences disappear after the tenth year of life when the ratio of the diameter/length of the upper respiratory tract becomes the same in both sexes, probably because of the changes to the wall of the thoracic cavity that develops in puberty in boys but not in girls¹⁵.

Later the differences between the sexes are lost, and it becomes more common in the female sex¹⁶ and hormonal regulation of airway responsiveness must be considered as a potential mechanism for this⁶.

Accordingly and taking into consideration the differences between the sexes, it is important to make a diagnosis in good time for boys with repeated bronchoobstructive episodes and introduce adequate anti-inflammatory therapy in order to prevent later structural changes that could limit physical, emotional and social life of the patients in adulthood and change their quality of life.

The average rate of asthma incidence in the five-year period observed for both sexes was 0.67/1000. In relation to the age groups for both sexes, the highest average incidence was in the middle age group 0.98/1000 and lowest in the youngest age group – 0.36/1000. The average asthma incidence in boys was 0.86/1000. The highest incidence was in the middle age group – 1.2/1000, then in the oldest group – 0.77/1000. The least was in the youngest age group – 0.57/1000. The average asthma incidence in girls was 0.47/1000. The highest incidence was in the middle age group – 0.74/1000, then in the oldest – 0.48/1000 and least in the youngest age group – 0.15/1000.

In the study in Northern Sweden over a two-year period, the cumulative incidence of asthma was 1.7% in children 7–8 years of age, i.e. 0.9/1000 *per year* in the first year, and 0.8/1000 in the second year of the study¹⁷. In our study the larger incidence of asthma in males of all age groups is in accordance with the studies of other authors^{4,19}. Observing the annual changes of the incidence it is evident that asthma incidence is fairly stable. The lowest was in 2007 (0.57) and the highest was in 2005 (0.83).

The few last decades have shown that the rate of incidence and asthma prevalence in the world is constantly growing. This increase is evident in all age groups, especially in children. Thus, in Great Britain, which is considered to have a high incidence and prevalence of asthma for children aged 0–4 years, in 1993 an increase of 11-fold was recorded in relation to 1976, while in 2000 it was 70/100,000 children of pre-school age and 50/100,000 for children aged 5–15 years²⁰. It is clear from numerous studies in the world that there is a constant trend of a growing incidence and prevalence over the last few decades. A similar trend is expected in the future even in countries with a relatively low asthma incidence and prevalence. This is an important medical problem and although the cost of preventive treatment of asthma might be expensive, the cost of inadequate treatment of asthma is even higher.

Conclusion

The average rate of asthma incidence in the observed five-year period in children 0–14 years old in the Tuzla Canton area was 0.67/1000. The epidemiological data obtained could be useful for early detection and adequate treatment of children suffering from asthma in that area, what can certainly ensure this specific population a better quality of life.

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H. Tahirović

Tuzla University Clinical Center, Department of Pediatrics, Trnovac bb, 75000 Tuzla, Bosnia and Herzegovina
e-mail: husref.tahirovic@untz.ba

UČESTALOST OBOLJELIH OD ASTME KOD DJECE IZ TUZLANSKOG KANTONA

SAŽETAK

Astma je jedna od najčešćih kroničnih bolesti, čija učestalost pokazuje konstantni rast u djetinjstvu. Cilj ovog rada bio je proučiti učestalost oboljelih od astme među djecom iz tuzlanskog kantona, i to s obzirom na dob i spol. Istraživanje je obuhvatilo djecu oba spola, dobi 0–14, koja su bolovala od astme u periodu od 1. siječnja 2003. do 31. prosinca 2007. Ukupna učestalost i učestalost s obzirom na dob i spol je računata kao udio djece koja boluju od astme (0–14 godina) na 1000 djece iste dobne skupine u Tuzlanskom kantonu. Astma je dijagnosticirana kod 277 djece (66,1% muške i 33,9% ženske). Razlika u frekvenciji astme kod djevojčica i dječaka je bila značajna ($\chi^2=56,16$; $df=1$, $p<0,0001$). Prosječna razlika u udjelu kod djevojčica i dječaka bila je 32,2% (95% CI=24,32–40,08). U ovom uzorku dječaci su imali 3,8 puta veći rizik (OR=3,79; %95 CI=2,67–5,39) od oboljenja od astme. Prosječna učestalost za oboljenje od astme kod oba spola u proučavanom razdoblju iznosila je 0,67/1000 (95% CI; 0,6–0,7; za dječake 0,86/1000; za djevojčice 0,47/1000). Značajno viša učestalost oboljenja od astme utvrđena je dječake u odnosu na djevojčice ($t=6,3836$, $df=32$; $p<0,0001$). Epidemiološki podaci bi bili iznimno korisni za rano otkrivanje bolesti i adekvatno liječenje djece oboljele od astme u spomenutom području.