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Bronchitis and Environment

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1. Introduction

Acute bronchitis is an inflammation of the big bronchi mucosa that develops and heals rapidly in fifteen days at the latest. Coughing that lasts more than five days is the cardinal symptom. Production of sputum and fever exists in cases with an infectious cause. Chronic bronchitis is defined having sputum production for three months or more, two years in a row. The prevailing complaint is dyspnea. Bronchitis occurs with the inhaling of the infectious agents or physicochemical agents via the airway. Environmental factors are effective in the development of bronchitis.

2. Etiology in bronchitis

2.1 Infectious causes

2.1.1 Bacteria

H Influenzae, S pneumonia, M catarrhalis account for 70% of all exacerbations and 85-95% of bacterial exacerbations. After those responsible Staphylococcus aureus, Pseudomonas aeruginosa, opportunist gram-negatives and mycoplasmma pneumonia are the most frequent bacterial agents in order of frequency. (Ball, 1995; Boldy et al., 1990; Johnson et al., 1997; MacKay et al., 1996). Mycoplasma pneumoniae, Chlamydophila pneumoniae rarely contribute to the causes of acute bronchitis (Wenzel & Fowler, 2006).

2.1.2 Viruses

Influenza/parainfluenza viruses, Respiratory syncytial virus, rhinoviruses and coronaviruses account for 30% of all acute infective exacerbations (Ball, 1995; Boldy et al., 1990; Jonsson et al., 1997; MacKay et al., 1996).

2.2 Chemical causes

Relationship between the consumption of domestic coal per acre in 1952 and the average annual death rates from bronchitis of males aged 45-64 years from 1950 to 1952, in 83 counted boroughs of England and Wales are one of the first studies that put emphasis on air pollution in developing bronchitis. In this study as the consumption of domestic coal per acre had increased, deaths from bronchitis also increased. (Daly C,1954). Industrial pollution is a major precipitant in air pollution. Before the death incidents due to smogs that took place in 1950s and 1960s in London and Los Angeles, Reid and Fairbairn had previously defined the relationship between fog and work absenteism due to bronchitis among London postmen during the 1940s. During the 1950s in Great Britain, it's been

showed that there is a correlation between the measurements of sulphur dioxide and deaths due to bronchitis in all the years for men that are over 45 and in some of the years also in women. (Pemberton & Goldberg, 1954). The basis of warming and pollutants from industry are particulate matter and sulphurdioxide. In Donora (Pennsylvania), London and New York, in 1940s, 50s and 60s episodes of severe air pollution resulted from sulfur dioxideand particulate matter (1996). Clean Air Act was created in 1971 in the United States six criteria air pollutant, ozone, particulate matter, sulfur dioxide, nitrogen dioxide, lead, and 189 units were identified toxic or hazardous air pollutant (Clean Air Act., 1971)..

The main components of particulate matter are sulfates, carbonmaterials, nitrates, trace elements and water. (Dockery & Pope, 1994) Of those pollutants Sulphur dioxide (SO2) and respirable particulate material up to 10 microns (PM10) in diameter are most frequently held responsible for the contamination and health effects. Therefore, in routine measurements they are considered first. According to NAAQS (National Ambient Air Quality Standards) standards and limit values for pollutants that affect health primarily are: Annual Arithmetic Mean for Sulfur Dioxide (SO2) 0:03 ppm(80µg/m3), 24 hour limit is 0:14 ppm (365µg/m3), Suspended Particulate Matter (PM10) limit value for the annual arithmetic average is 50 µg/m3, boundary value for 24 Hours is 150µg/m3 (Evyapan, 2010).

Children are more affected by air pollution than adults. Because 80% of alveoli forms postnatally and full development of the lungs continues until the age of six to eight. (Dietert RR at al, 2000; Plopper &Fonucchi, 2000).

Research linking air pollution with morbidity and mortality indicates the strongest effects on the very young and the elderly (Picciotto IH et al., 2007). In their study of 2010 Benrayeb and colleagues investigate the relationship between air pollution in France and individuals over 65 with bronchitis-like symptoms . In this study they found a 10% and a 23% increase in usual cough for a 10 $\mu g/m^3$ increment in PM_{10} and a 1 $\mu g/m^3$ increment in SO_2 respectively, and a 23% increase in usual phlegm for a 1 $\mu g/m^3$ increase in $SO_{2..}$ A more pronounced effect of SO_2 and PM10 was observed in women on cough and phlegm. (Bentayeb et al., 2010).

Especially exhaust fumes by vehicles are being held responsible of ambient air pollution more than industrialization, and warming up (Bates, 1995; Ana et al., 2000, ISDE, 2003). The WHO study in the three countries, investigated the effects on health of air pollution from traffic, PM10 was found to be the most harmful pollutant. The chronic bronchitis incidence of whom are over 25 years attributed to total air pollution cases or days are 6 200 for Austria, 36700 for France, 4 200 for Switzerland. These patients under the age of 15 for bronchitis or days, are 47700, 450000, and 45400 respectively. Within These the cases or days attributed to the road traffic for over the age of 25 chronic bronchitis patients are 2700 for Austria, 20400 for France, 22000 for Switzerland, for bronchitis patients under age 15 are 20600, 250000, and 24100 respectively (ISDE,2003). Besides ambient air pollution quality of indoor air pollution (Kurmi et al., 2010, Galeone et al., 2008, Padhi&Padhy, 2008) and the cigarette smoke (Pirastu et al., 2009; Vial, 1986) are important environmental factors responsible for the formation of bronchitis. Biomass fuels that are used at homes (Ekici et al., 2005; Özbay et al., 2001; Kiraz et al., 2003; Akhtar et al., 2007), solid fuels (Kurmi et al., 2010, Galeone et al., 2008, Padhi&Padhy, 2008) that form these are counted for the chemical elements of the environment. In the meta-analysis that Kurmi had done, there were positive associations between the use of solid fuels and COPD and chronic bronchitis. Pooled estimates for different types of fuel show that exposure to wood smoke while performing

domestic work presents a greather risk of COPD (Chronic obstructive pulmonary disease) and chronic bronchitis than other fuels. In many areas of Africa, Central America, South-East Asia, and South Asia, more than 90% of rural homes use solid fuel as the primary cooking and/or heating fuel. Of these fuels the use of biomass and wood, coal causes chronic bronchitis more than charcoal (Kurmi et al., 2010). In the study of Padhi and Padhy, children whom biomass is used in their homes and suffering from respiratory tract infection are compared to children whom in the homes liquified petroleum gas (LPG) is used and have respiratory tract infections. Impaired lung function were more for users of biomass. (Padhi&Padhy,2008). The outcome of this study shows that the use of biomass as a cooking fuel produces high concentrations of CO, CO2, NO, NO2, SO2 and SPM in the indoor environment in comparison to LPG. A questionnaire survey of children aged between 9 and 12 years in Turkey, which included spirometry, found that coal users had more day/night cough, and that those using wood-burning stoves had the lowest values of FVC, FEV, PEFR, and FEF25 (forced expiratory flow rate at 25 % of lung volume) (Güneser at al, 1994). In Turkey since the 1970s warming, industrialization and road traffic have caused outdoor air pollution. In 1970's in Ankara, in 1980's in İstanbul, especially with the 1973 oil crisis, when the use of lignite coal has increased air pollution has increased too. (Evyapan, 2010).

Sulphurdioxide which forms as a result of the combustion of coal, petrol and fuel oil is the most common aetiology of bronchitis (Hapcıoglu et al., 2006; Schwela, 2010). Sulphur dioxide increases the mucosal permeability of the trachea and bronchi, inhibits the ciliary movements and mucous transport (Güler&Cobanoglu, 1997). Water soluble gases, sulfur dioxide and ammonia are absorbed via bronchi, ozone and nitrogen gases which are relatively non-absorbable are effective on the alveolar region that is not covered with the mucosa (Güler&Cobanoglu, 1997). Large particles, 50 micrometers in diameter in the breathing air are usually struck with the nose and pharynx. Small particles of 10 micrometres can reach alveoli. The relation between PM10 or PM2.5 exposure and acute health effects is linear at concentrations below 100 micrograms/m3 (Schhwela, 2000). There are studies that didn't determine a (Patenden et al., 2006) correlation between nitrogen dioxide and bronchitis as well as that do (Schwela, 2010). A statistically significant relationship is confirmed between polycyclic aromatic hydrocarbons (PAHs) that are greater than 2.5 microgram in diameter and the bronchitis observed in children between 3-4.5 years (Picciotto et al., 2007).

Acute and chronic bronchitis is observed often in the workers working in the fields exposed to dust and hazardous gases. Analysis of epidemiological data from the 1930s and 1940s confirmed the impression of a strong link between occupation and chronic bronchitis. In the 1950s and early 1960s, irreversible airflow limitation and emphysema, which are funtional and pathological abnormalities associated with chronic bronchitis, were shown to be increased among mineworkers. The preventability of occupation related disease influence researchers about chronic bronchitis and environmental exposure (Trupin at al, 2003). In the study of Trupin et al. post occupational exposure significantly increased the likelihood of chronic obstructive pulmonary disease, independent of the effects of smoking. One of five cases of COPD may be attributable to occupational exposures. In this study 42% of 189 subjects self reported vapours, gases, dusts or fumes. 29% of them exposed combustion by products, 23% ınorganic dusts or fumes, 15% organic dusts. Job exposure matrix, exposure probability is 69% low, 24% intermediate, 6% high (Trupin et al., 2003). Some of the branch of industry-economic activity along with cigarette smoking that are held responsible for chronic bronchitis are fields that cause exposure to asbestos, cement, grain working, textile

industry (cotton, hemp, flax dust) and welding (irritant gases, metal fumes, dusts) (Benowitz & Hua, 2004). The most commonly held minerals responsible for chronic bronchitis are coal, oil mist, silica, synthetic vitreous fibers, portland cement and metals are osmium, vanadium, welding fumes (Balmes, 2004).

2.3 Physical causes

It is known that bronchitis has always been initiated with cold weather and high humidity (Fletcher at al, 1959). The units such as school and barracks where communal life are cause the agents to spread easily and let epidemias break out (Schima&Adachi, 2000; Chen at al, 1998; Aydogdu&Assan, 2005; Kak, 2007). The presence of an crowded environment, with close interaction between individuals, increases the risk of persons being exposed to various respiratory secretions and potentially infectious respiratory viruses (Kak, 2007). Bronchitis is related to seasons and change of air. In a study conducted in Ankara the lowness of the daily temperature and of the amount of precipitation increases the risk of wheezing (Yalçın, 2010). High humidity and air pressure, and low temperature (Hapcıoglu et al., 2006) increases the incidence of bronchitis (Chen et al., 2008). In the study of Hapcıoglu et al. when the meteorological and pollution parameters were evaluated by multiple variable stepwise regression analysis, it can be seen that the only variable that explaints the COPD admissions is temperature (Other variables were pressure, humiditiy, S02, CO, NO, NO2 and PM10). Authors noted that seasonal variations exist for COPD admissions. They reported that they found admissions more in autumn, spring and winter when summer seasonal values are taken as reference (Hapcıoglu et al., 2006). In the study of Chen et al. chronic bronchitis was mainly concentrated in August and September. They explained this situation with the sudden change from cold to hot during the use of air-condition. Weather change was an important factor, especially when temperature change rapidly, and the daily average temperature fell more than 3°C bronchitis occur (Chen et al., 2008). The important factor was the amplitude of the temperature change was small, but the temperature changed frequently. When the activity of cold and warm air is sudden or frequent, there is a greater incidence of disease. This occured when hot and cold weather appeared alternately, but the fluctuation was under 3° C (Chen et al., 2008). It's been thought that the changes happening in the bronchi enable the viruses and bacteria to effect mucosa of the bronchi with relative ease.

3. Epidemiology

When looked at the relationship of bronchitis with age, small airway inflammation are observed more often in kids 6 months to 4 years old, acute bronchitis are more often in children and adolescents, whereas chronic bronchitis prevalance increases with age in adults and elderly (Chen et al., 2008). In the study of Picciotto, the overall rates for lower respiratory illness, bronchitis, and croup in children under 2 years of age were 83, 55 and 27 per 1000 child-months, respectively (or expressed equivalently, 8.3%, 5.5%, and 2.7% per month (Picciotto, 2007). Bronchitis rates in this age group were also higher in children of mothers with lower education, and children from homes with adults who smoke, or homes in which coal was used for heating or cooking. Current or recent breast-feeding was protective, as was older maternal age. In a study conducted in China, 5.9% of patients who has chronic bronchitis and asthma are between the age of 51-55, 16.2 % are seen in age 71 to 75 (Chen et al., 2008). In a study done in Boston the prevalance of chronic bronchitis is 4.5%

(Bhattacharyya, 2009). In Istanbul among the children whose mean age is 13 the bronchitis (acute and chronic) frequency is found to be 6.5% in the health problems they are aware of (Onal et al., 2009). In Nigeria school-age children reported over 10% for prevalence of bronchitis (Ana GR at al, 2009). Bronchitis is more common in young children, especially under the first age (Chen at al, 2008); The frequency increases with age after middle age, children and the elderly more easily had bronchitis (Prieto, 2007). In the study established with postal workers, in London, in 1959, Fletcher and his colleagues were found cough and sputum more in men than in women. Symptoms increases with age in men. Ventilatory capacity was significantly impaired in the men. The authors suggest these results is related to more cigarette smoking (Fletcher, 1959).

4. Diagnosis

The clinical symptoms of bronchitis are coughing, expectoration and fever with an infectious aetiology. In acute bronchitis coughing will go on for more than five days and recovers in two weeks. Bronchitis which take longer than 3 months for two consecutive years are called chronic bronchitis (Fletcher et al., 1959, Kilburn, 1998). Coughing and expectoration are seldom seen in chronic bronchitis. Dyspnea is the most important symptom and wheezing the most important sign. Ever since Badham (1808) first introduced the word bronchitis to medical literature it has been customary to include dyspnoea together with cough and expectoration as an essential symptom of bronchitis. Oswald (1958) describes two types of disability of bronchitis; breathlessness and exacerbations of infection; the presence of either of which justifies the diagnosis. Pemberton (1956) and Ogilvie and Newell (1957) accepted cough and sputum as evidence of bronchitis in earliest phase. To admit the diagnosis of bronchitis all those who have persistent cough and sputum is essential from the point of view of preventive medicine (Fletcher et al., 1959) . Today, some clinicians considered that making a diagnosis of bronchitis based on defined criteria for chronic sputum production is easy, but has limited clinical value (Clausen, 1990). For the differential diagnosis the chest radiograph is necessary. The studies continue about the place of high-resolution computed tomography in the diagnosis (Gupta et al., 2009). The respiratory functions are disturbed in patients. The measurements made by spirometer (difficult to conduct in children younger than 6 years old). Forced vital capacity (FVC), forced expiratory volume (FEV) and peak expiratory flow rate (PEFR) shows reversible decrease (Padhi&Padhy, 2008; Schwela, 2010). Evidence of airflow obstruction forced expiratory volume in one second (FEV1) less than 80% of the predicted value, and FEV1/FVC less than 70%, with an increase of less than 10% in FEV1 after inhalation of a β-agonist aerosol indicate COPD (Zalacain et al.,1999).

5. Treatment

The treatment of acute bronchitis is symptomatic. Nonsteroid antiinflammatory drugs and nasal decongestants are recommended. In the clinical studies conducted during the treatment of acute bronchitis the antibiotics are ineffective. In the case of bronchitis which produce sputum antibiotic treatment is appropriate to be administered according to the culture-antibiogram result. H. Influenzae infections give better reponse to amoxicillin and ciprofloxacine, while erythromycin, azithromycin and amoxicillin are more effective in S. Pneumoniae infections (Ball,1995). Humidifying treatment hastens the recovery of the

illness. Short and long acting bronchodilators (beta-2 agonists) are effective in chronic bronchitis. The epidemiologic studies conducted found out that there is a correlation with the air pollution (especially suspended particulate matter PM10-PM2.5) and the use of bronchodilator drugs (Schwela, 2000).

Results of placebo-controlled trials of efficacy of antibiotic therapy in acute exacerbations of chronic bronchitis show that in defined exacerbations, the patients benefit significantly from antibiotic therapy. Patients who had exacerbations characterized by increses in dyspnea, sputum production, and sputum purulence. In 1987 Anthonisen and coworkers either demonstrate that in the group of patients who take amoxycillin, co-trimoxazole or doxycycline the clinical succes is %68, otherwise in the placebo group clinical succes was %55. In Allegras' study, the clinical succes of patients who take co-amoxyclavin was %86, otherwise in placebo group was %50 (Ball, 1995).

6. Prevention

Quitting smoking, staying out of foggy, dusty, smudge environment is important for prevention and treatment. Quitting smoking is possible with pharmacological treatment such as bupropion HCL and varenicline. Nicotine replacement therapy is possible with nicotine tape, nicotine gum and nicotine sublingual tablet. Measures against occupational exposure should be taken if necessary. Haveing a flu vaccination once a year and having the vaccinations in the routine vaccination program of children and elderly (such as pneumococcus and H. influenzae vaccination) is important in prevention of bronchitis.

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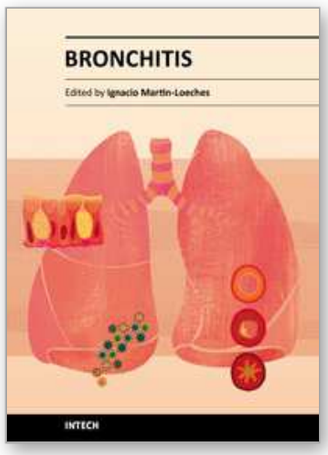

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Lung parenchyma has been extensively investigated. Nevertheless, the study of bronchial small airways is much less common. In addition, bronchitis represents, in some occasions, an intermediate process that easily explains the damage in the lung parenchyma. The main target of this book is to provide a bronchial small airways original research from different experts in the field.

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