Medical-geographical indicators of the Altai Krai as a cross-border region of Western Siberia

S Tokmakova¹, O Bondarenko¹* and Y U Lunicyna¹

¹ Altai State Medical University, 40 Lenin str., Barnaul 656038 Russia

E-mail: agmuterst@mail.ru

Abstract. As a result of a comprehensive study on the methodology of the World Health Organization, the dental incidence of children and adults in the districts of the city of Barnaul with different levels of air pollution has been studied. It is established that the ecological situation in the city is complicated by the emissions of harmful substances by industrial enterprises (nitrogen dioxide, formaldehyde, soot, dust). The structure of the indicator of the intensity of teeth caries of hard tissues in key age groups was studied, and a positive correlation was found between the intensity of dental caries in adolescents of Barnaul and the exceeded emission concentrations of the air pollutants studied by us. A high prevalence of dental anomalies in adolescents has been established. The prevalence of periodontal and oral mucosa diseases was evaluated in the examined individuals. It was revealed that this pathology did not depend on the degree of contamination of the air basin in the districts of the city of Barnaul. Analysis of the conducted clinical and epidemiological research reveals the features of dental pathology in various age groups of a large industrial city of the Siberian region. The data can be used for a differentiated approach in creating and planning programs to improve the prevention of dental health of the population, taking into account the environmental situation in the districts.

1. Introduction

The Altai Krai, like most other regions of Siberia, is characterized by a tense ecological situation, uneven density and steady trends in the health of the population. Studies of domestic and foreign scientists have established that environmental pollution is of no small importance in the violation of public health. For many years, the ecological situation has been aggravated by the functioning of the Semipalatinsk test site for nuclear devices, the concentration of large industrial enterprises polluting the air in the cities of the region and its capital. The adverse effect on the prevalence of dental morbidity has water supply, which is carried out according to the Center for State Sanitary and Epidemiological Surveillance of the city of Barnaul from sources with a low content of fluorine and microelements [1], [2], [3]. Ecology, visceral pathology and dental diseases are interdependent and interrelated. The most common dental diseases are the defeat of hard dental tissues, periodontal pathology, dentofacial anomalies, diseases of the oral mucosa, as evidenced by epidemiological studies in recent years [4], [5]. An analysis of the prevalence and intensity of oral pathology under the influence of harmful environmental factors in various districts of the city of Barnaul will make it possible to develop a prevention strategy that can be extrapolated to transboundary regions.
2. Materials and Methods
To assess the prevalence and intensity of dental diseases, a comprehensive dental examination of the population of five districts of the city of Barnaul was carried out according to the WHO methodology in key age groups: 6, 12, 15 years, 35-44 and 65-74 years. A total of 1,250 people were examined, of which 542 were males and 708 females. The examination was carried out under standard conditions, the results (179 signs) were recorded in the assessment chart of dental status. Climate-geographical features of the regional center of Altai were studied using reference data on the climatology of the USSR and the West Siberian Hydrometeorological Center, based on the average annual data on temperature, force and wind direction, number of sunny days per year. The environmental situation was assessed according to the state of the air and water basins of the city of Barnaul. We used data from the Research Institute for Water and Environmental Problems of the West-Siberian Branch of the Academy of Sciences, the General Directorate of Natural Resources and Environmental Protection of the Ministry of Natural Resources of Russia for the Altai Krai.
To characterize the water basin, data from the center of state sanitary and epidemiological surveillance of the city of Barnaul on the condition of drinking water in the studied areas on the content of fluoride and mineral substances were used.

3. Results
In the air basin of the city of Barnaul, Altai Krai there is a high concentration (above the maximum permissible value) of carbon monoxide, nitrogen dioxide, formaldehyde, soot and dust. The highest emissions of harmful substances are registered in the Zheleznodorozhny and Oktyabrsky districts of the city of Barnaul, where the atmospheric pollution index is characterized by a high (1 < API ≤ 4) and high degree (4 ≤ API ≤ 16), respectively.
In 12-year-old children with severe pollution of atmospheric air with nitrogen dioxide, formaldehyde, there are extraoral signs of damage (r ≈ 0.3, p < 0.05). When contaminated with dust, soot and formaldehyde in 15-year-olds, a high intensity of caries of hard dental tissues is observed (r ≈ 0.4; r ≈ 0.3, r ≈ 0.4, p < 0.05, respectively). These pathological changes are prevalent mainly in the Zheleznodorozhny and Oktyabrsky districts of Barnaul.
A high prevalence of dental caries was found in 12 and 15-year-old children, especially in the Oktyabrsky district (94.0%), and 100% caries susceptibility of adults at high intensity. In indicator of intensity in 6-year dental caries predominates temporary teeth, 12, 15 year old - fillings permanent teeth in adults - extracted teeth. For the first time, 12-year-old children began to observe removed permanent teeth (2.0 ± 2.0 - 4.0 ± 2.79%).
Non-caries lesions of hard dental tissues, in the form of focal and diffuse spotting (up to 50%), are not associated with the intensity of air pollution with harmful substances. Fluorosis among the population of the regional center of the Altai Krai was not identified, which is probably due to the low fluorine content in drinking water in all areas of the city (0.19-0.22 mg / l).
The prevalence of pathology of the oral mucosa and temporomandibular joint increases with age (up to 40%, 50%, respectively) and does not depend on the degree of air pollution.
Against the background of the high prevalence of periodontal diseases (84-100%), the severity of tissue damage is negligible in childhood (tartar, gingival bleeding). It increases in the middle and older age groups (periodontal pockets of different depths) and does not depend on the emissions of the air pollutants we studied in Barnaul. Despite the fact that WHO recommends at least three healthy sextants, in adults in the CPI index only ¼ - ½ sextant were on average healthy. Dental calculus was observed significantly more often in 35–44-year-olds at 1.34 ± 0.30 - 1.98 ± 0.40, compared to 6-, 12-year-olds in all areas, and in the elderly - at 0.60 ± 0.12 - 1.28 ± 0.20 sextant. Dental anomalies in 12-, 15-year-old children are found in 62%, 59%, respectively, and are not associated with emission concentrations of harmful substances. Of the pathological signs, the crowding of the teeth on the lower jaw prevails, a deep bite. Their stomatological aesthetic index (DAI) averages 18.0 ± 0.7, which basically requires minimal therapeutic interventions.
4. Discussion

The high prevalence of dental caries among the young population of Barnaul confirmed the fact that the state of children's health is one of the most sensitive biological indicators that reflect the quality of the environment. Our results correlated with research data from ecologically unfavorable areas of the country, which attributed a large number of caries-affected teeth to a number of reasons: lack of ultraviolet rays, nutrition imbalance (seasonal changes in the diet of children), high air pollution, low fluoride content in drinking water and low levels oral hygiene. The incidence of pathology of hard dental tissues among the middle and older age urban population was high and comparable with the results in similar areas in ecology and climate and geographical location [5], [6], [7].

Our findings on the prevalence of periodontal disease at a young age are consistent with the results of studies in the European North, Krasnoyarsk Krai, and the Far East, where gum lesions were recorded in 64.0-100% of cases. Although, the author found that in the Novosibirsk region a high prevalence and intensity of diseases of the periodontal disease is observed in areas affected by atmospheric emissions from industrial enterprises. Also in the components of the CPI index, 15-year-old children of the Republic of Udmurtia have already registered periodontal pockets 4-5 mm deep. According to the researchers, the cause of high susceptibility of periodontal tissues is a low level of oral hygiene, poor quality prosthetics, multiple somatic pathology, lack of qualified dental consultation on oral care, and to a certain extent the environmental situation (impact of atmospheric emissions from industrial enterprises) [8], [9].

Although we have not identified the dependence of the prevalence of non-carious teeth lesions on air pollution, a number of authors have noted in their studies; for example, its increase due to the accident at the Chernobyl NPP, which affected most Europeans.

The prevalence of diseases of the oral mucosa in Barnaul is similar to other regions of Russia, and our data correlate with the results of a number of researchers [8], [9]. Despite the fact that the etiology and pathogenesis of these diseases are not fully elucidated, the authors have no doubt that the pathological processes on the mucous membranes (candidiasis, lichen planus, diseases of the tongue and others) are the result of diseases of internal organs, disorders of metabolic processes, nervous system activity, changes immune system, adverse environmental conditions.

5. Conclusion

Thus, due to our research, a high prevalence and intensity of caries, gum disease, dental mandibular deformities, temporomandibular joint and oral mucosa has been established. The connection between the incidence of hard tooth tissues in children and the emission of harmful substances by industrial enterprises was also revealed. At the same time, the quality of medical and preventive care of various dental diseases to the population has not reached international standards and needs to be improved. The frequent occurrence of caries and periodontal diseases in children, and as a result, 100% incidence in adults and the elderly, requires the urgent universal introduction of primary preventive measures developed taking into account climate and other geographical features of the regions in order to effectively plan dental care for people of various ages, groups. Inadequate quality of treatment of hard dental tissues, as well as periodontal disease, should direct managers of the city dental service to a differentiated approach to planning preventive and curative work of major oral diseases in most areas of the regional center of the Altai Krai. The results of studying the influence of environmental factors on the dental morbidity of children can be used in the practice of sanitary doctors, as well as pediatricians and pediatric dentists in the city of Barnaul during an annual in-depth medical examination. The experience of numerous studies in other regions [2], [3], [4], p5] suggests that it is possible to reduce the prevalence and intensity of dental pathology by introducing a comprehensive prevention program that takes into account environmental indicators.

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