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CHARACTERISTICS OF ACOUSTIC RESPIRATION IN SMOKING TEENAGERS

Summary

Study of epidemiological characteristics of smoking in teenage population of the Republic Sakha (Yakutia) gives evidence about rather wide spreading and high intensity of smoking among both boys and girls.

Analyzing results received from smoking teenagers we came to the conclusion, that smoking ones have breach of bronchial termeability accompanied with noticeable changes of breathing patterns.

Keywords: teenagers, bronchographia, smoking teenagers.

Due to the high incidence of deviations in the behavior of adolescents, especially high negative forms is urgent to study habits in adolescents, including smoking, which gradually leads to development of functional disorders of the respiratory system. [4]

Currently, computer-based research and analysis of respiratory sounds can quantify respiratory disorders in chronic and acute respiratory diseases in infants and older children. Today, there is a project called Computerized Respiratory Sound Analysis (CORSA) with the participation of foreign researchers. CORSA project aims at the systematic study and development of computer analysis of respiratory sounds. [5]

PURPOSE: To determine the performance of the acoustic respiration and its relative performance by bronhophonography adolescent smokers compared with nonsmokers teenagers.

Research methods

Bronhophonography method (BFG) was developed by Professor SJ Kaganov at the Moscow Institute of Pediatrics and Pediatric Surgery, Health Ministry on the proposal to the Moscow Power Engineering Institute. [3]

At the heart of BFG is an analysis of frequency response range of respiratory sounds. The principle of the method consists of recording respiratory sounds that occur during breathing and changing in various pathological conditions. Direct recording from a sensor with high sensitivity in a wide band of frequencies, including frequencies that are not detected on auscultation, but are of great diagnostic value.

The sensor unit is designed to remove, capture and digital input signal with subsequent transmission to the input port of the computer consists of three basic elements:

1. Sensor acoustic noise;
2. Amplifier that provides the necessary signal level;
3. Analog-to-digital converter (ADC) to convert the analog waveform into a discrete (digital).

In the hardware part of the complex also includes a set of filters designed to generate the frequency spectrum, which contains useful information about the specific acoustic phenomena. In order to prevent cardiac noises are special low-pass filters. Scanning the respiratory cycle is in the frequency range of 100 Hz to 12,600 Hz. The results of computer processing of the measurement results are displayed on the PC screen. Thus obtained is a graphical representation bronhophonograph is called "breathing pattern". [3]

The procedure for recording respiratory sounds made by means of a face mask, with insertion of the sensor, which is gently pressed against the nasolabial triangle. For older children and adults, the sensor is placed in a special mouthpiece. Audio signal is transformed by the analog-to-digital

converter (ADC) in the discrete form, can process and displayed on the PC screen.
The results of the acoustic portrayal respiratory cycle represented as a set of equidistant instantaneous spectra, forming a three-dimensional "surface states", which displays the specific acoustic phenomena that have diagnostic value. Produced record is scanned into a computer display screen, and is conditionally divided into three areas: 1.2 kHz - Region pueril breathing with 1,2-5 kHz - low-frequency region of 5-12,6 kHz - high-frequency region.
For the convenience of evaluation identified changes, you can use the coefficients proposed by the authors of the diagnostic complex, reflecting the acoustic work of breathing in relative units [1, 2].
k1 - is an expression of the relationship of the index, the cost of the emergence of low-frequency waves (1,2-5 kHz) to the base paper (0.1-1.2 kHz) to estimate the acoustic work in the low frequency range.
k2 - is the ratio of energy consumed to the emergence of high-frequency waves (5-12,6 kHz) to the base paper (0.1-1.2 kHz) to estimate the acoustic work in the high-frequency region.
k3 - reflects the ratio of total acoustic work of breathing in all frequency bands, to the basic work of breathing (0.1-1.2 kHz).
In order to improve the reliability of the diagnosis in the channel configuration includes room monitor the patient's breathing (through headphones) to compare individual knowledge and experience of the doctor with the results of computer processing.
Bronchopulmonary obstructive changes are associated with a specific acoustic phenomenon - the emergence of reliable diagnostic features (wave oscillations) at relatively high frequencies (above 5000 Hz). Characteristics of the acoustic patterns are only part of a comprehensive study of the parameters of lung function. The combination of these acoustic patterns with speed and time parameters of respiratory function gives a more complete picture of ventilation disorders in children with bronchopulmonary diseases typical of obstructive and / or restrictive lung diseases.
BFG method allows to quantitatively present the characteristics of obstructive disorders of respiratory noise, control the therapy, monitor the condition of children.
Thus, using the BFG registered specific acoustic manifestations occurring in the bronchopulmonary system of the child, which may be of diagnostic value, and to complement the information obtained by the traditional methods.

Results of the study

Our study was conducted on the basis of secondary schools in the Republic of Sakha (Yakutia). With computer diagnostic complex "pattern" was conducted screening bronhophonography 60 adolescents 15 years. Of these, there were 34 boys, 26 girls. Study group included 30 adolescents with behavioral disorders and with the experience of smoking more than 5 years, the control group consisted of 30 non-smoking teens.
Statistical analysis of the data was performed using the SPSS version 14.0 for Windows. Processing of the results carried by conventional methods and parametric variation statistics. The significance of differences was determined by the t - test Student's -Fisher ($p < 0,05$).
The obtained data are shown in Table 1, 2.
The index of acoustic respiration in the low frequency range (1.2 - 5 kHz) was significantly higher in young smokers - 95,78 ± 72,01 nJ, adolescents in the control group - 17,83 ± 12,84 nJ, in the high range (5 -12.6 kHz) were also significantly higher in adolescent smokers - 3,03 ± 1,40 nJ, adolescents in the control group - 0,41 ± 0,38 nJ.
Ratio (relative value) in the low frequency range (1,2-5 kHz) was significantly higher in smoking adolescents - 21,56 ± 14,64, adolescents in the control group - 16,71 ± 12,17, in the high frequency range (5 - 12.6 kHz) were also significantly higher in adolescent smokers - 0,63 ± 0,18, in adolescents in the control group - 0,41 ± 0,21.
Thus, the absolute and relative performance of the acoustic work of breathing in smoking adolescents with smoking history of more than 5 years was significantly higher than in non-smokers, which is a sign of the presence of chronic bronchopulmonary disease.

Findings

1. Bronhophonography method is non-invasive reliable method for studying lung function in bronchopulmonary disease.
2. Smoking teenagers have bronchial obstruction accompanied by distinct changes in the pattern of breathing.

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Tab. 1
Acoustic indicators of respiratory groups
(Absolute figures)

Acoustic work	basic group	Control group
ARD 1 (low)	95.78±72.01*	17.83±12.84
ARD 2 (high)	3.03±1.40*	0.41±0.38
ARD 3 (common)	98.80±62.82*	18.24±15.10

Note:* Significant difference indices (p <0.05) in groups of adolescents with deviant and normative behaviors.

Tab. 2
Indicators of acoustic respiration
(Relative, ratios)

Coefficients	main group	Control group
C 1	21.56±14.64*	16.71±12.17
C 2	0.63±0.18*	0.41±0.21
C 3	20.94±14.53*	16.30±12.07

Note:* Significant difference indices (p <0.05) in groups of adolescents with deviant and normative behaviors.

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