

RISK ANALYSIS IN OCCUPATIONAL MEDICINE

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PREVENTION OF CANCER RISK IN THE GLASS FIBERS MANUFACTURE EMPLOYEES

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In the long glass fibers manufacture, operators are exposed to a complex of carcinogenic chemicals discharged into the working environment (including formaldehyde, chloromethyl oxirane, hydrochloride, ethanoic acid and mineral oil spray). The penetrating effect of harmful substances through the skin is enhanced by fine glass dust which has a traumatic and irritating effect. Aggravating factors of soaking oils influence on the operators were super-ambient temperature and excess heat radiation. Unfavorable climate at the workstation is also a factor of risk. Among the occupational patients (71 of 170 employees surveyed) there dominated people aged 50-59 years. The patients mean age at hyperkeratosis detected was 51.9 ± 0.9 years, skin cancer: 57.3 ± 1.7 years. Occupational skin neoplasms were diagnosed mainly in the employees with the professional employment period of over 10 years (mean age 12.6 ± 2.4 years). The transformation period of local hyperkeratosis into skin cancer averaged from 5 to 8 years. It's found that molecular-genetic factors predisposing to the development of occupational skin lesions are polymorphic variants of the tumor suppressor gene TP53 (Ex4+119G>C, IVS3 16 bp Del/Ins and IVS6+62A>G).

It's shown that the development of preventive measures aimed at reducing the risk of occupational disorders is relevant and should be provided through the interaction of enterprise management, engineering and technical staff, labor protection service, Rospotrebnadzor (Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing) experts, occupational therapists and employees themselves. We offered the measures in complex of primary and secondary prevention of health problems and showed the necessity to introduce long glass fibers manufacture into the list of production processes carcinogenic for humans according to national regulatory documents.

Key words: long glass fibers, employees, malignant neoplasm, preventive measures.

Malignant neoplasm is one of the greatest medical concerns. The given pathology is the second leading cause of death, following just behind cardiovascular diseases. Official statistics show a steady

increase in cancer incidence and mortality in Russia. The growth in the cancer morbidity rate over the last 10 years has exceeded 17% [5].

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Studying the effects of carcinogens in production processes on employees in various industries was the subject of numerous research works, including those that show the proportion of occupational malignancies ranges from 4 to 40% of all cancers [1, 8 – 12, 14]. A number of national and foreign researchers considered deeply the prevalence of malignant neoplasm among people employed in coal and coal processing, as well as chemical industry [4,13]. Special aspects in cancer prevalence in women employed in different industries were studied [15]. However, in Russia etiological relevance of occupational factors in the development of malignancies is not considered actually. The proportion of malignant neoplasms in the structure of all newly diagnosed occupational pathologies consistently ranks last, making 0.4 – 0.6%. Low detection rate of cancer in relation to professional activity of patients can be explained by the poly-etiology of the given disorder and the need to exclude non-occupational factors, as well as the long latency period of the disease [7].

Long glass fibers manufacture is an important sub-sector of the chemical industry. Fiberglass products, having a number of valuable properties (strength, non-combustibility, corrosion resistance), are widely used in electronics, aviation, rocketry.

For over twenty years, fiberglass production workers in the Republic of Bashkortostan register professional skin tumors as benign (hyperkeratosis) and malignant (skin cancer) [2, 3,6].

Over the past decade, production of fiberglass has been updated with new equipment, soaking oils composition has been changed by reducing the carcinogenic substances applied. Despite the improvements in technologies, staff working environment is not safe, new cases of occupational diseases are recorded each year.

The above identifies relevance of studying the working conditions in fiberglass production, risk factors for occupational pathology, structure and dynamics of occupational diseases aimed at developing a system of preventive measures.

Materials and methods. The study was done at one of the largest fiberglass production enterprises in Russia, using sanitary, clinical laboratory, and statistical methods. Workstations of the operators in long glass fibers production were studied. Hygienic assessment of the working conditions was carried out in accordance with the Guidance R. 2.2.2006-05. The influence of harmful factors on the formation of occupational pathology was studied.

A retrospective analysis of the occupational morbidity dynamics at the enterprise for the period from 1994 to 2013 was done. The study involved 170 fiberglass production workers, of those: 71 patients with occupational skin neoplasm and 99 operators of long glass fibers production with no occupational pathology. In the group of patients 53.5% were male and 46.5% female. Among them people aged 50-59 years and 60-69 years dominated. An employment period of all patients exceeded 10 years. The group of healthy operators included 47 women and 52 men. Most of them were aged 30-39 years and 40-49 years. 46.5% of workers had the professional employment period of less than 10 years, 11 years and longer: 53.5% of the people under survey.

Results and discussion. Our studies showed the effect of pollutants in a complex of soaking oils, fiberglass dust, noise and heating microclimate on the core profile workers, i.e. operators of long glass fibers production.

Soaking oil used in production technology is a multi-component mixture composed of harmful substances of the 2-3^d hazard class (from high-risk to moderately hazardous).

A number of substances (formaldehyde, chloromethyl oxirane, hydrochloride, ethanoic acid and mineral oil spray) found in the soaking oil, have carcinogenic effects. The operators working conditions in terms of chemical factors correspond to the third class of the second degree (by a combination of substances which have a carcinogenic effect). The operators working conditions were generally assessed as corresponding to the class 3.3.

Penetrating effect of soaking oils was enhanced with fine fiberglass dust contained in the working area, and settling on the contaminated surface of hands skin added the traumatic and irritating effect. In addition, the aggravating factors of soaking oils influence on the operators were the super-ambient temperature and excess heat radiation. In our opinion, all the above factors in complex determine the risk of occupational dermatopathy in the given industry employees.

An analysis of occupational morbidity dynamics showed its fluctuations during the observation period (20 years). The highest rates were recorded in 1998, 2002, 2006, and made respectively 89.4, 92.4 and 70.4 per 10,000 employees.

There are 97 people currently registered with the consulting and outpatient clinic department of FSFI (Federal State-Funded Institution) "Ufa Research Institute of Occupational Medicine and Human Ecology", having occupational skin tumors, in-

cluding 74.2% of local hyperkeratosis and 25.8% of skin cancers. At the same time six patients are diagnosed with two occupational diseases: contact dermatitis and local hyperkeratosis, and one patient with two occupational malignant tumors: skin cancer and lung cancer.

Occupational patients were mostly aged 50-59 years. The patients mean age at the time of hyperkeratosis detection was 51.9 ± 0.9 years, skin cancer: 57.3 ± 1.7 years. Occupational skin neoplasm was diagnosed mainly in the workers being employed for over 10 years (mean period 12.6 ± 2.4 years). The transformation period of local hyperkeratosis into skin cancer averaged 5-8 years.

It was found that molecular-genetic factors predisposing to the development of occupational skin problems are polymorphic variants of the tumor suppressor gene *TP53* (Ex4 + 119G> C, IVS3 16 bp Del/Ins and IVS6 + 62A> G). The identified genetic markers may be used as prognostic criterion for individual risk of occupational skin neoplasm, addressing the issues of prevention and smart employment management.

The comprehensive clinical and hygienic studies were the basis for the development of preventive measures aimed at reducing the risk of occupational skin neoplasm in fiberglass production. The proposed complex should be implemented at the corporate level and individually (Fig. 1).

Both, corporate and personal levels foresee the principles of primary and secondary prevention.

Primary prevention of occupational diseases is aimed at preventing the occurrence of malignant skin tumors and benign diseases that precede them in the form of hyperkeratosis by eliminating or reducing the exposure to risk factors, compliance with a healthy lifestyle.

Corporate procedures include the provision of safe working conditions, limiting employees contact with substances of cancerogenic risk by improving and automating technology process, the development of new formulas for soaking oils, avoiding harmful substances with highly carcinogenic effect. Reducing the exposure to occupational carcinogens can be achieved by effective ventilation systems implemented.

Every employee must be informed on the working conditions and the potential risk of developing occupational skin neoplasm, trained in safe working procedures with mandatory use of personal protective equipment.

Primary prevention of occupational skin neoplasm in fiberglass production involves also the pre-placement and regular medical examinations, health

checks based on the common and additional contraindications.

Employees' health care including the pre-placement (at employment) and regular medical examinations should be carried out in accordance with the orders of the Health Ministry of Russia dated April 12, 2011 No. 302n "On approval of the lists of harmful and (or) hazardous production factors and works, subject to compulsory pre-placement and regular medical examinations (checks) and the Order of the mandatory pre-placement and regular medical examinations (checks) of the employed in heavy works or works under harmful and (or) dangerous conditions" (as amended on May 15, 2013). Contraindications for employment in the production of fiberglass are chronic diseases of skin and respiratory system, allergic diseases of any severity, benign tumors of any location prone to degeneration, the presence of specific polymorphic markers. Individuals who have previously had occupational exposure to carcinogens are not desirable to be employed in glass fibers production.

Medical care of the employed in the enterprises with carcinogenic hazard should focus on identification and treatment of chronic background and precancerous diseases.

Oncologic vigilance is needed from the doctors who conduct regular medical examinations of fiberglass production workers. After leaving the production when retired, workers must undergo medical examination with a view to early detection of occupational skin cancer.

In order to improve the professional selection of employees, forecasting risk of occupational skin lesions and formation of high-risk groups, it is advisable to use molecular-genetic studies.

It should be noted that the decision of each person on the need for genetic studies is to be voluntarily, on the basis of his full awareness of the ongoing manipulations and confidentiality. Detection of susceptible individuals will reduce the risk of occupational skin neoplasm in fiberglass production employees. At the same time, according to the guidelines of the International Labor Organization, the employer must not be informed about the examination results without the employee's consent. In order to avoid discrimination, the employee only, being aware of the risk, should make a decision, whether to work in hazardous working conditions or not.

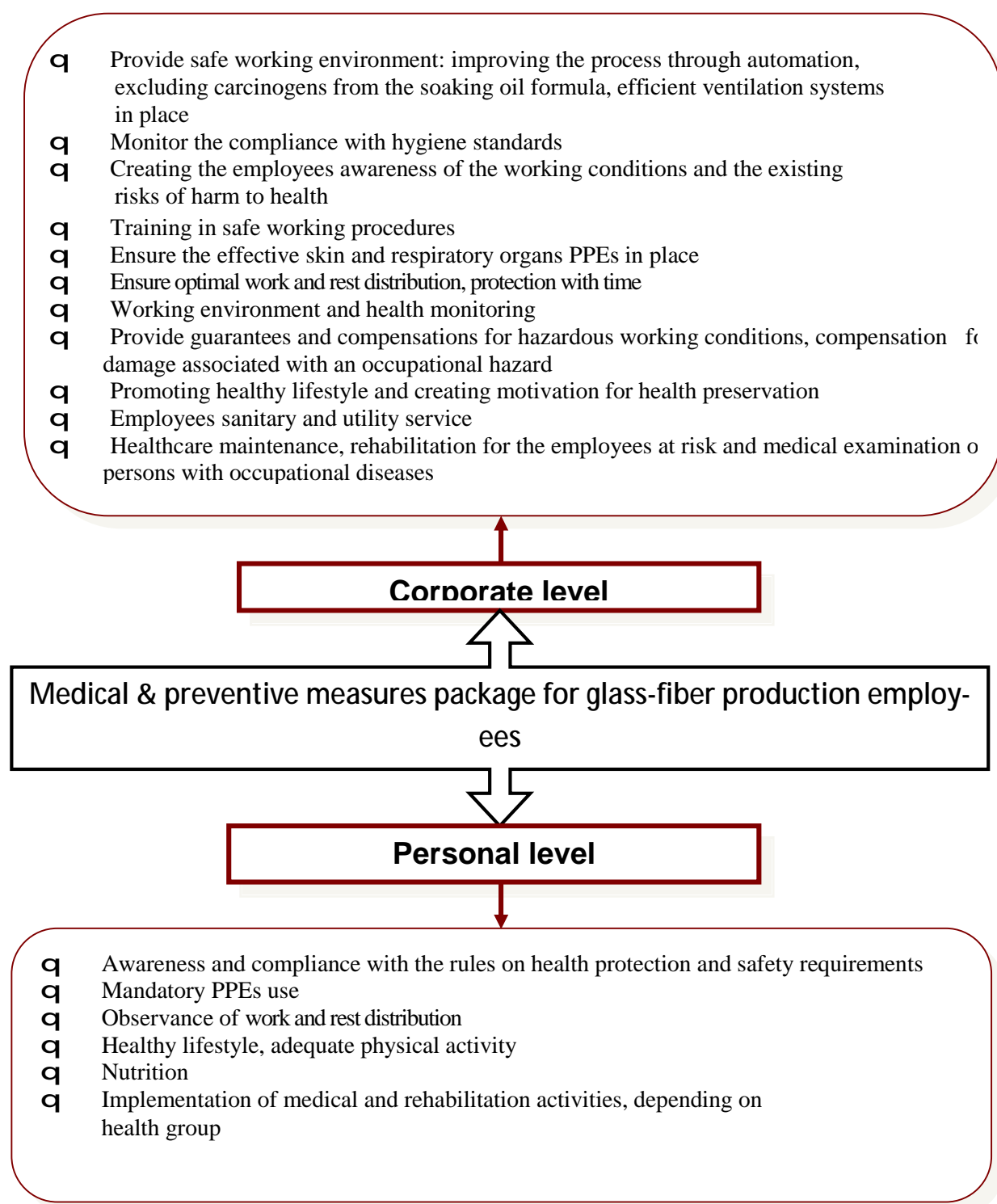


Fig.1. Medical & preventive measures package for glass-fiber production employees

Features of the medical supervision and the recommended complexes of therapeutic measures are determined by a group of dispensary registration (Fig. 2). Secondary prevention of occupational skin cancers in fiberglass production employees

provides detection and treatment of cancer at the early stages and the precancerous conditions prior to, employees' medical examinations and recovery, health, labor and social rehabilitation.

In connection with occupational skin cancer, issues of compensations for damages to health should be addressed.

Working conditions and employees health status monitoring is needed.

Conclusions. Prevention of occupational skin cancers at the corporate level is to include the interaction of management, enterprise engineering and technical staff, labor protection service, Rospotrebnadzor (Federal Service for Surveillance

on Consumer Rights Protection and Human Well-being) experts, occupational therapists and employees themselves.

Studies dictate the need to introduce long glass fibers production into the list of production processes carcinogenic for humans, as stated in SanPiN 1.2.2353-08* "Carcinogenic factors and basic requirements for the prevention of carcinogenic risks".

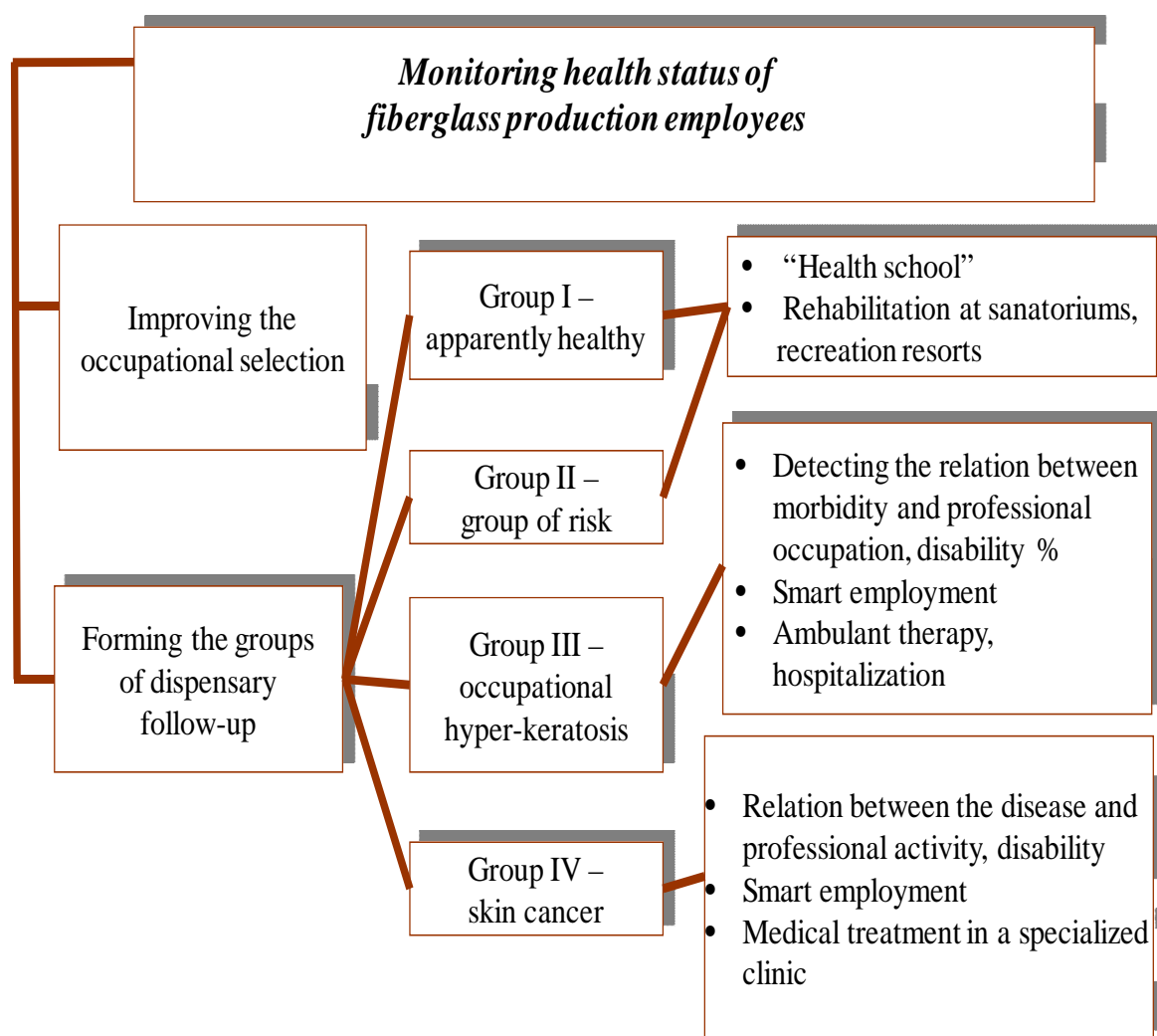


Fig. 2. Monitoring health status of fiberglass production employees

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