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RISK ASSESSMENT OF ORGAN OF VISION'S NEOPLASMS IN WORKERS EMPLOYED IN THE MODERN OIL INDUSTRY

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1,852 employees from 13 enterprises of the oil and gas production profile of the State Oil Company of the Republic of Azerbaijan participated in the study. Clinical examination at the workplace was carried out in 2018–2019 using a mobile clinic operating at the National Center of Ophthalmology named after Acad. Zarifa Aliyeva. The severity of labor was assessed in three groups: class A – optimal, class B – acceptable and class C – harmful working conditions. Of all respondents, 46.5% noted the presence of direct contact with harmful substances during work, 30.5 % – the presence of indirect contact. Pseudo – (49.2 %) and neoplasms (61.6 %) were detected in 33.4 % of workers exposed to exposure. The RR assessment showed that the probability of the development of pseudo – and neoplasms of the visual organ among the studied contingent exposed to exposure is higher than in non–exposed 2.7 (CI=1.95–3.86; $\chi^2=35.87$, $p<0.05$) and 3.4 (CI=2.49–4.62; $\chi^2=65.75$, $p<0.05$) times, respectively. The statistically–based data obtained will allow us to develop proposals to reduce the risk of developing the studied nosologies among workers employed in the modern oil industry.

Key words: neoplasms of the eye, labor severity, relative risk, exposure to harmful substances, oil industry.

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ОЦІНКА РИЗИКІВ ВИНИКНЕННЯ НОВОУТВОРЕНЬ ОРГАНУ ЗОРУ У РОБОТНИКІВ, ЗАДІЯНИХ У СУЧАСНІЙ НАФТОВІЙ ПРОМИСЛОВОСТІ

Об'єктом дослідження стали 1852 працівники з 13 підприємств нафтогазовидобувного профілю Державної нафтової компанії Азербайджанської Республіки. Клінічне обстеження на робочих місцях проводилось у 2018–2019 роках із використанням мобільної клініки, що діє при Національному центрі офтальмології імені академіка Заріфи Алієвої. Тяжкість праці оцінювалася за трьома групами: «клас А» – оптимальні, «клас В» – допустимі та «клас С» – шкідливі умови праці. З усіх опитаних, 46,5 % відзначили наявність безпосереднього контакту із шкідливими речовинами у процесі роботи, 30,5 % – наявність непрямого контакту. У 33,4 % працівників, що піддаються експозиції, виявлено псевдо – (49,2 %) та новоутворення (61,6 %). Оцінка RR показала, що ймовірність розвитку псевдо- та новоутворень органу зору серед досліджуваного контингенту, що піддається експозиції, вища, ніж у неекспозованих у 2.7 (ДІ=1.95–3.86; $\chi^2=35.87$, $p<0.05$) та 3.4 (ДІ=2. $\chi^2=65.75$, $p<0.05$) рази, відповідно. Отримані статистично-обґрунтовані дані дозволять розробити пропозиції щодо зниження рівня ризику розвитку нозологій серед працівників, зайнятих у сучасній нафтовій промисловості.

Ключові слова: новоутворення ока, тяжкість праці, відносний ризик, експозиція шкідливими речовинами, нафтова промисловість.

The problem of studying the influence of the production environment of oil workers on their health (including eye health) is constantly in the focus of attention of Azerbaijani scientists of various specialties – clinicians, hygienists, toxicologists, ophthalmologists, oncologists, etc. [3, 5]. In conditions of sustainable development for the implementation of new projects in the oil sector of Azerbaijan, the constant increase in the capacity of facilities, their modernization dictate the need for a detailed study of the possible adverse effects of various production factors on the body of workers, including their ophthalmological status. [1] At the present stage, forecasting the risk of diseases with temporary disability, production-related occupational diseases, development of recommendations for primary prevention are of great importance for the socio-economic development of the oil industry. It is known that various chemical factors (oil and its refined products, industrial gases, heavy metal compounds, salts, alkalis and other toxic compounds) present at oil-producing and oil-refining enterprises can have an adverse effect on the health of workers, including the development of visual organ formations [2, 11]. However, it should be taken into account that the degree of risk at different enterprises of the petrochemical industry varies, which requires additional comprehensive and detailed studies [3, 4].

Currently, pseudo- and neoplasms of the eye and its accessory apparatus, their timely detection, treatment and prevention are an important problem of ophthalmology [6, 13]. The increase in scientific interest in this problem is explained by the fact that neoplasms of the visual organ not only cause a cosmetic defect, but can lead to severe changes. As is known, nevi due to the risk of developing melanoma can pose a serious oncological threat, especially under the influence of harmful working conditions [3, 12]. Therefore, timely detection, monitoring, and removal can help reduce cases of their malignancy and the development of melanomas. In this connection, the task of modern ophthalmological science is the timely early diagnosis of neoplasms of the organ of vision and the search for ways to prevent their occurrence.

The analysis of the existing world models of occupational risk assessment has shown that it is advisable to use a single methodology [9, 10]. Since the impact of the use of risk analysis of certain production factors in the oil sector on the development of ophthalmopathologies will allow in the future to solve a number of important tasks, such as the development of a mechanism and strategy for various regulatory measures to reduce them; obtaining quantitative characteristics of potential and real damage to health from the effects of these factors; establishing more reliable safe levels and hygienic standards; assessment of possible risk levels that may persist after the application of measures, etc. [7, 13]. In this regard, the use of evidence-based medicine tools will allow us to most accurately characterize the degree of possible influence of production factors on the risk of developing neoplasms of the visual organ in workers employed in the modern oil industry.

The purpose of the study was to evaluate the influence of harmful substances and the severity of working conditions of workers employed in the modern oil industry on the occurrence of pseudo- and neoplasms of the visual organ.

Material and methods. The object of this study was selected employees employed in organizations and divisions of the oil and gas production profile of the State Oil Company of the Azerbaijan Republic (SOCAR). The criterion for inclusion in the cross-examination was: the employment of the subject at one of the SOCAR enterprises, regardless of age, work experience and the severity of work. A total of 1,852 employees from 13 SOCAR enterprises who voluntarily agreed to participate in the study were covered by a systematic random sample. The studies were conducted in 2018–2019.

The severity of work was assessed according to the HESCME principle (“Health, Environment and Social Capital Management in Enterprises”) [10] and divided into three groups – class A – optimal conditions, class B – Acceptable conditions and class C – harmful working conditions. The distribution of employees by age showed that the most numerous (52.0 %) was a group of people aged 46 to 59 years. The average age of the employees was 48 years (min=19; max=67; median Me=50; mod Mo=56).

To assess the needs of workers in the modern oil industry in health promotion and substantiate measures to meet them, questionnaires developed by us (N=1852) were used, including questions about the presence of contact with harmful chemicals in the workplace (HC). According to ethical standards, informed consent was obtained from each subject to participate in the survey.

The studied diagnoses were classified according to ICD–10 by nosological groups of ocular pathology “Pseudoformations of the eye and its appendage”: xanthelasm (H.02.6), pingvecula (H.16.2), chalazion (H.00.1), pterygium (H.11.0) and “Neoplasms of the eye and its appendage”: nevi: episclers (H.13.8), conjunctiva and cornea (H.13.8), choroids (H.18.7), irises (H.18.) and melanoses (conjunctival (H.13.8), limbal (H.11.4).

When assessing the ophthalmological status of workers employed in the modern oil industry, a general clinical study was conducted at the workplace using a mobile clinic operating at the Academician Zarifa Aliyeva National Center of Ophthalmology (NCO) and equipment provided by the NCO. The following methods of comprehensive ophthalmological examination were used: visometry was performed on the Huvitz Chart Projector CCP–3100 (HUVITZ Co, LTD, South Korea), biomicroscopy of the anterior segment of the eye was performed on a TOMEY slit lamp (TOMEY TSL–5000, Tomey, Japan) and on a portable slit lamp (Reichert, Japan), refractometry was performed on The RC–5000 automatic keratorefractometer (TOMEY, Japan), ophthalmoscopy of the fundus was performed on a TOMEY TSL–5000 slit lamp (Tomey, Japan) using lenses (Ocular High Mag 78D, Ocular Instruments Inc., USA). [5]

The relative risk index (RR – relative risk) was calculated with a 95 % confidence interval (CI) to identify the dependencies of the influence of workers' contact with harmful chemicals on the occurrence of neoplasms, as well as their etiological fraction (EF – etiological fraction) – an indicator of the specific weight (in %) under the influence of the assessed risk factor in the total amount cases of detected diseases. The correlation relationship of the indicators was studied using the parametric correlation coefficient of Pearson (χ^2) and Spearman (p). For all the above analyses, the differences were considered significant at a significance level of $p < 0.05$, where the minimum confidence was 95 %.[7] Calculations were carried out using the MS Excel package.

Results of the study and their discussion. All the working conditions of the surveyed workers in our study were divided into 3 classes. Under Class A are assigned optimal conditions for the activities of oil workers. This category makes it possible to engage in work activities without harm to the health and vital activity of the employee. Industrial factors do not adversely affect its performance. The permissible working conditions Class B include conditions when the influence of HCV does not go beyond the existing norms, and the efficiency of employees reaches full recovery by the new shift. Harmful working conditions are classified under Class C. In this group, the influence of negative industrial factors within the working

environment that can lead to changes in the general state of the worker's body, including visual organ disorders, is beyond the norm. After the shift, there is a long recovery.

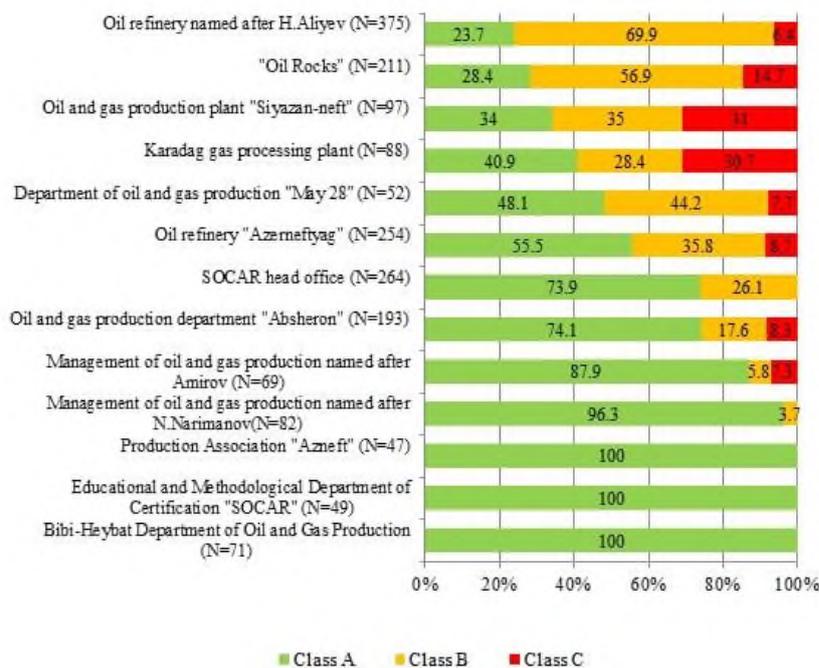


Fig. 1. Working conditions of workers in modern oil production

named after N.Narimanov, Azneft Production Association and the SOCAR Educational and Methodological Certification Department). Working conditions about a third of the jobs at the Siyazan-Neft refinery (31 %) and at the Karadag refinery (30.7 %) are classified as harmful Class C.

The study of the opinion of workers in the modern oil industry showed that 46.5 % (861 respondents) have direct contact with harmful chemicals substances (HCS) and oil in the course of work. 564 respondents (30.5 % of all respondents) noted the presence of indirect contact with HCV. Of all the employees surveyed, 426 respondents (23.0 %) noted the absence of contact with harmful chemicals. According to the groups of severity of labor, it was found that in Class A there was no contact with HCS, in Class B in more than 50 % of workplaces there is an exposure in the production process. In Class C, in 100 % of cases, direct or indirect contact with HCS is indicated.

The absence of exposure to harmful substances at workplaces in the Class A group does not exclude other indirect factors of industrial influence on the formation of ocular pathology, such as office work, outdoor work, in rooms with insufficient illumination.

Respondents indicated contact with both crude oil in the fields and with its processed products at processing plants, as well as with the reagents used: acids, alkalis, solvents, catalysts, etc. The results of the ranking of the frequencies of the HCV groups, to which workers of the modern oil industry can be exposed in the production process, are shown in fig. 2.

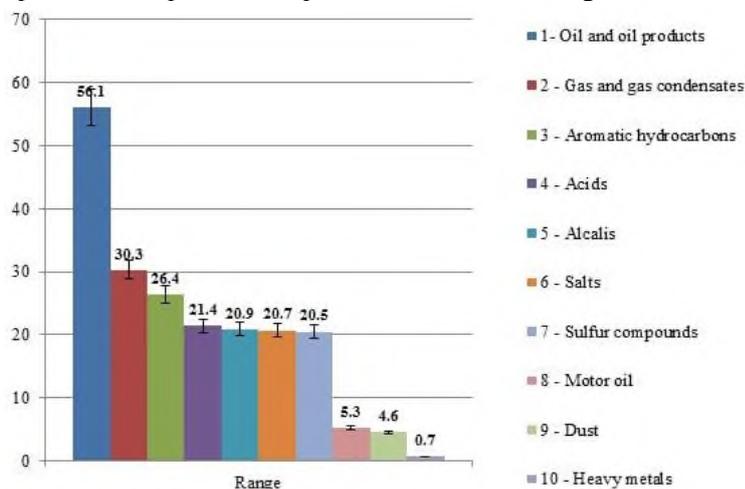


Fig. 2. Results of frequency ranking of groups of harmful chemicals in modern oil production (N=435)

As a result of the study of the working conditions of each employee employed in modern oil production, it was found that 1028 (55.5 %) jobs in the enterprises as a whole belong to the production severity group of Class A, 665 (35.9 %) – Class B and 159 (8.6 %) – Class C. However, the picture changed for individual departments and enterprises (fig. 1).

As can be seen from Figure 1, the enterprises of the modern oil industry with good working conditions Class A include departments (Bibi-Eibat Management, SOCAR head office, Oil and Gas Production Department

As can be seen from fig. 2, most often – in 244 cases (56.1 % of all these groups of harmful substances), workers in modern oil production have to come into contact with oil and petroleum products. Gas and various gas condensates are listed in second place (30.3 %). Only 3 respondents indicated contact with heavy metals during work, which amounted to 0.7 % of all these groups of harmful substances.

The calculation of extensive indicators showed that among all the examined 307 (33.4 %) workers who have contact with HCS during

production revealed various diseases of the visual organ. In 124 (13.3 %) examined patients, despite the presence of exposure, no ocular pathology was detected.

Only 151 (49.2 %) of all examined patients with any ophthalmopathy had pseudoformations and 189 (61.6 %) had neoplasms in both eyes (OU). Moreover, in 79 cases (52.3 %) of pseudoformations and 90 cases (47.6 %) of neoplasms were registered in a form combined with other ophthalmopathologies (19.6 %).

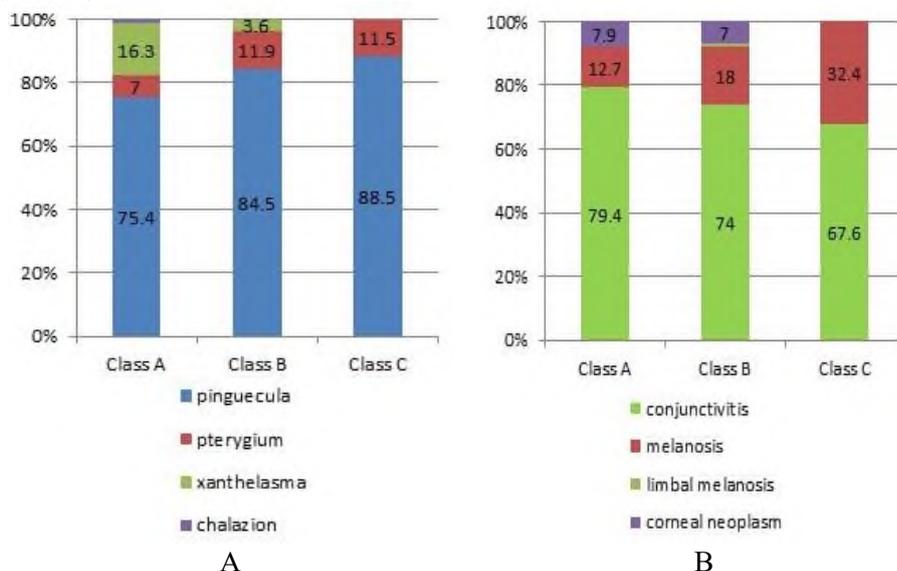


Fig. 3. Structure and nature of the revealed pseudo- (A) and neoplasms (B) of the visual organ by severity groups of production in workers employed in the modern oil industry

The detection of pterygium in the surveyed in production groups with permissible and harmful working conditions, it was 12 % each. In the production group with optimal working conditions Class A, the proportion of detected xanthelasm was statistically significantly higher ($\chi^2=5.7$ ($p<0.05$)) than in the other production groups and amounted to 16.3 % of all detected ophthalmopathologies.

Conjunctival melanoses occupy the largest share of workers employed in all occupational hazard groups – from 67.6 % Class C to 79.4 % Class A. Moreover, in the production group with harmful working conditions, the detection rate of melanosis was statistically significantly higher ($\chi^2=6.2$ ($p=0.002$)) than in other production groups, and amounted to 1/3 of all detected neoplasms in both eyes.

The obtained, at first glance, uninformative from the point of view of the share distributions of individual ocular neoplasms, do not reveal a statistically significant difference between all groups of labor severity ($p=0.07-0.09$). In this regard, the calculation of RR and EF can serve as a visual evidence base.

The results of the study of the relative risk and etiological proportion of the occurrence of pseudo- and neoplasms of the eye in workers employed in the modern oil industry from the presence of contact with harmful substances are presented in Table 1.

Table 1

Association between the presence of contact with harmful substances in modern oil production and the development of pseudo- (PO) and neoplasms (NO) on both eyes (OU)

OU	Contact with harmful substances	Presence of pathology	Absence of pathology	RR	95 % CI	χ^2	P	EF (%)
PO	Yes	66	375	2.74	1.95–3.86	35.87	p=0.003	49.2
	No	85	1326					
NO	Yes	90	351	3.39	2.49–4.62	65.75	p=0.004	61.6
	No	99	1312					

As can be seen from the table, the probability of developing pseudoformations of the visual organ among workers employed in the modern oil industry who have industrial contact with HCS is 2.7 times higher than among workers who do not have contact with harmful substances during work (RR=2.74; CI 1.95:3.86). The probability of developing neoplasms of the visual organ among workers those who have industrial contact with HCS are 3.4 times higher than those who do not have contact with harmful substances during work (RR=3.39; CI 2.49:4.62). According to the manual on the assessment of occupational risk to the health of workers [6], based on the calculations obtained, the degree of causal relationship between the influence of HCS in the process of work and the occurrence of pseudoformations of the visual organ was estimated by us as high (under the condition of $2 < RR < 3.2$, EF=33–50 %), and very

high – for eye neoplasms (when condition $3.2 < RR < 5$, $EF = 51-66\%$), which allows us to consider the nosologies studied as production-related diseases.

Unlike the previous scientific publications of Azerbaijani ophthalmologists [1, 3, 5], the novelty of this study lies in an integrated approach covering all types of production of the modern oil sector using such modern criteria of evidence-based medicine as indicators of relative risk and etiological proportion. It has been established that the absolute risk of pseudo- and neoplasms among workers engaged in harmful conditions of the oil industry is still high, despite the automation and modernization of production. As many foreign authors point out [8, 13], scientifically-based knowledge of the degree of risks can contribute to timely prevention, early diagnosis and adequate treatment of eye diseases of oil industry workers, which, in turn, will help protect the professional fitness of oil workers and prevent disability associated with visual impairments. The prospects for such studies should be to study not only the impact of the severity of the working conditions of oil workers on the ophthalmological status, but also their age and work experience. An important role can be played by research on the search for immunological criteria – the study of the level of interleukins and cytokines in the lacrimal fluid of workers who perform the function of mediators of the relationship between the immune system and the new development, which will allow detecting pathology at early stages.

Conclusions

1. According to the results of the study, it was found that the etiological share of pseudo- and neoplasms in the total number of cases of detected ophthalmopathologies on both eyes under the influence of the risk of harmful chemicals during production in the modern oil industry is high and amounted to 49.2 and 61.6 %, respectively.

2. The probability of developing pseudo- and new formations of the visual organ among workers employed in the modern oil industry who have industrial contact with HCV is higher than among workers who do not have contact with harmful substances during work in 2.7 ($CI = 1.95-3.86$; $\chi^2 = 35.87$, $p < 0.05$) and 3.4 ($CI = 2.49-4.62$; $\chi^2 = 65.75$, $p < 0.05$) times, respectively.

3. The revealed degree of causal relationship between the influence of harmful substances in the process of work and the occurrence of pseudoformations of the visual organ can be assessed as high (under condition $2 < RR < 3.2$, $EF = 33-50\%$), and very high – for neoplasms of the eye (under condition $3.2 < RR < 5$, $EF = 51-66\%$), which allows us to consider the nosologies studied as professionally-caused diseases.

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Стаття надійшла 22.02.2022 р.