Medical Education

Issues Related to Occupational Safety during Work with Anticancer Drugs

Olga Malyshevska*, Iryna Myshchenko, Zoriana Suslyk

Abstract
Labor conditions of junior medical staff at oncological institutions and risks arising in the course of their work are presented in the present article.

Topicality. Monitoring of hygienic labor conditions conducted at cancer oncological institutions of Ukraine has shown that 80-85% of junior medical staff's work conditions do not meet the requirements of occupational health and safety standards and therefore refer to work under harmful and dangerous conditions. Taking into account the above mentioned information, the research focused on health protection of junior medical staff during work with carcinogens as well as introduction of newest health and safety procedures into learning process is very actual and prospective.

Problem statement. Most anticancer drugs used for oncology patients' treatment have significant non-selective, toxic effects on the body as well as mutagenic, carcinogenic influence. However, not only treated patient's organism is affected by such exposure but junior medical staff preparing, administrating and doing utilization of drugs as well. Therefore, this category of medical staff needs maximal protection. Their working conditions also require maximal control and correspondence to occupational safety rules.

The objective of the research was to substantiate the necessity of introduction of questions related to occupational safety during work with anticancer drugs into the syllabus of junior medical staff in order to provide safe working conditions. The questions related with occupational safety during work with anticancer drugs should be also introduced to the learning process of the discipline "Occupational safety in the field". This will provide an opportunity to prevent and avoid the development of work-related diseases, including occupational cancer among junior medical staff.

Conclusions and prospects for further research. Introduction of questions related to occupational safety during work with anticancer drugs into the discipline "Occupational safety in the field" for junior specialists will allow to decrease the level of work-related diseases and other professional pathology among junior medical staff during work with harmful oncogenic drugs. The prospects of further researches involve developing of diet and preventive nutrition for junior medical staff working with anticancer drugs development of new measures and methods of individual and collective protective measures from harmful oncogenic drugs.

Keywords
occupational safety of health care workers; occupational safety in oncology center; carcinogenesis; occupational carcinogenesis; occupational cancer

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Topicality
Monitoring of junior medical staff labor conditions in Ukrainian oncological institutions has shown that 80-85 percent of them do not meet occupational safety requirements and can be referred to category of work with harmful and dangerous conditions [1]. Therefore, the research in the field of occupational health and protection of junior medical staff during work with harmful oncogenic drugs (HOD) as well as implementation of newest methods of labor protection into the learning process are very topical and prospective approaches.

Problem statement and analysis of the recent research
The majority of anticancer drugs used for oncological patients’ treatment have significant non selective, toxic impact on the organism as well as mutagenic and carcinogenic influence. However, not only patients but medical staff’s organisms undergo such influence. Definitely, junior medical staff is affected more intensively during drugs preparing, administration and utilization. Therefore, such category of medical staff requires maximal protection and control of labour conditions at their workplaces should be the highest.

Researches dedicated to the origin and prevention of occupational cancer among medical workers were conducted by
State Institution “Institute for occupational health of Academy of Medical Sciences of Ukraine” and presented in scientific publications of many Ukrainian and foreign authors. They include the studies by Y. Kundiev et al. [2, 3], D. V. Varivonchik [4], D. V. Varivonchik et al. [5], V. I. Shevchenko [6], S. Tuljandin et al. [7], T.H. Connor and M. A. McDiarmid [8], B. W. Stewart and P. Kleihues [9], W. Fransman et al. [10], H. Kromhout et al. [11], S. Krstev et al. [12].

According to the data of International Labour Organization (ILO), occupational cancer morbidity is from 4.0 to 16.0 percent among all cases of malignant growth in countries with high level of industry development.

Percentage of patients with occupational cancer among the total amount of oncologic patients in Ukraine constitutes only 0.001-0.04 percent, that is significantly lower than ILO assessment. It shows that approximately 95 percent of detected cases of occupational cancer in Ukraine are suppressed [3].

Oncogenic drugs can pass into an organism in different ways such as inhalation, thermal, oral, parenteral ones (Table 1).

Inhalation route is possible during inhaling of dust and aerosols in the course of production, packing, transportation, storing, solutions preparation, powdering of tablets as well as during collecting, purification and utilization of medical products. Samples particles can spread by air after contaminated surfaces drying.

Another potential route of transmission is drugs contact with skin during entering into environment or touching of contaminated surfaces in the course of preparing, usage or drugs utilization.

Negative consequence for health of exposed workers is increased in the risk of malignant tumor development such as leukaemia, lymphoma, cancer of bladder, breast, skin, liver etc.

Non-oncogenic consequences include:

- acute: alopecia toxica, allergic dermatosis;
- chronic: infertility, spontaneous abortion, recurrent miscarriage, congenital defects among workers’ children, etc.

**Highlighting of unsolved issue**

Prevention of accidents, traumatism or occupational diseases is known to be easier than their treatment or relief of the consequences. Such necessary preventive measure could be teaching of occupational safety principles during work with HOD and target safety training at the workplaces to junior medical staff.

Nevertheless, the problem of studying of professional safety basics by junior medical staff at medical colleges is unsolved. Supplementation of the discipline “Occupational safety in the field” for junior specialists with questions related with occupational safety during work with anticancer drugs is essential as well as conduction of the researches in this field.

**The objective of the research** was to introduce the questions related to occupational safety during work with anticancer drugs into the discipline “Occupational safety in the field” for junior specialists. It allows prevention of occupational diseases origin such as occupational cancer among junior medical staff.

**Basic matter statement**

At the present stage an approach for occupational cancer prevention is based on ILO Convention No139 “Occupational Cancer Convention”, 1974. Convention concerns Prevention and Control of Occupational Hazards caused by Carcinogenic Substances and Agents (Entry into force: 10 Jun 1976). It was ratified by Ukraine on the 10th of March 2010.

Realization of occupational cancer prevention measures was implemented just partially in Ukraine during 1992-2015:

1. Statistic monitoring of patients with occupational cancer;
2. New version of hygienic standard “List of substances, stuff, working processes and environmental factors which are oncogenic for people” was implemented (2006) and the work on its improvement and review is underway (project of 2012);
3. Methods of oncogenic hazards assessment at the Ukrainian factories were suggested;
4. Criteria for expert determination of occupational cancer were offered;
5. Changes in the “List of occupational diseases” (2000) in part “Occupational cancer” were made according to new scientific data;
6. New version of “Procedure of medical examination of specific categories of workers” was presented where health monitoring program of workers under occupational exposure to carcinogens was provided;
7. Organizational standards of medical supervision for workers related to exposure to cancirogens at work were suggested [13].

The strategy concerning instruction of workers about labor safety and measures decreasing occupational cancer failed.

We think that problem can be solved by organization of periodical process of education at medical colleges and at the workplaces for junior medical staff. Only workers who have completed training in HOD safe using can be admitted for work. Additional training and professional development tests should be taken at least once a year.

This course should include information about:

1. Potential danger of HOD for workers who contact with them;
Table 1. Types of hazardous activity of medical staff in the course of work with HOD

<table>
<thead>
<tr>
<th>Group’s name</th>
<th>Types of hazardous activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurses, paramedics</td>
<td>intramuscular, endermic, intravenous drugs administration;</td>
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<tr>
<td></td>
<td>drugs administration through infusion sets or automatic measuring devices;</td>
</tr>
<tr>
<td></td>
<td>collecting and utilization of wastes contaminated by drugs;</td>
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<tr>
<td></td>
<td>performing of special manipulation (drugs administration into a tumor, etc.)</td>
</tr>
<tr>
<td></td>
<td>powdering of tablets for liquid drugs preparation.</td>
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</table>

2. Rules for HOD transportation;
3. Standards of HOD preparation for therapeutic usage;
4. Rules of HOD therapeutic use;
5. Code of good practice with HOD wastes;
6. Rules for individual protective measures use during work with HOD;
7. Information about absolute and relative health state contraindications for medical staff at work with HOD.

Warning signs about carcinogenic danger should be written and entrance of people into hospital who have not completed occupational courses and do not have special permission should be limited.

It is necessary to list employees eligible to work with HOD in order to limit a number of people who contact with them. Duration of work with HOD as well as with patients in the course of chemotherapy and after it should be within certain chronological framework. Working time should be minimized especially due to absence of thresholds in carcinogenesis development.

Medical staff eligible to work with HOD has to follow the rules of safety work, sanitary cleaning of premises, conducting of chemotherapy, nursing of patients after chemotherapy, collecting, keeping and utilization of dangerous samples.

General requirements for occupational safety of junior medical staff during receiving, keeping, medical usage and dealing with HOD wastes are the following (detailed instructions are presented in Table 2):

1. Nurses should use individual protective measures in all cases (respirators, gloves, protective cloth);
2. Using of catheters for HOD injection is preferred;
3. In case of HOD intravenous injection at first it is necessary to inject 0.9% physiological salt solution or other solvent (without oncogenic drugs) and then additionally administrate medication with HOD using dosing device;
4. Having finished the injection of HOD via infusion set it is necessary to administrate 0.9% physiological salt solution or other solvent for final cleaning of system from HOD;
5. All wastes should be sorted and utilized according to rules of occupational safety during work with HOD;
6. All materials contacting with HOD and biological liquids of patients before and after chemotherapy like urine, blood, sweat, vomiting mass might be marked as “dangerous”. Flasks, infusion sets and dosing devices for intravenous HOD injection, medical syringes, gloves, clothes, swaddling-clothes, diapers etc. refer to such materials;
7. Disinfection, laundry of clothes and linen contaminated by carcinogenic drugs should be done separately from each other;
8. Medical staff who contact with HOD or their wastes are provided with individual protective measures such as cotton medical overall, caps, rubber cover slats, latex gloves, goggles, face masks.

Contraindications for medical staff at work with HOD can be seen in Table 3.

Conclusions and prospects for further research

Introduction of questions related to occupational safety during work with anticancer drugs into the discipline “Occupational safety in the field” for junior specialists will allow to decrease the level of work-related diseases and other professional pathology among junior medical staff during work with HOD.

The prospects of further researches involve developing of diet and preventive nutrition for junior medical staff working with anticancer drugs development of new measures and methods of individual and collective protective measures from HOD.

References

Table 2. Requirements for occupational safety during work with HOD

<table>
<thead>
<tr>
<th>Activity</th>
<th>Requirements for occupational safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving and keeping of drugs</td>
<td>To wear individual protective clothes before working with HOD;</td>
</tr>
<tr>
<td></td>
<td>To mark all dangerous HOD;</td>
</tr>
<tr>
<td></td>
<td>To keep and deliver HOD in containers.</td>
</tr>
<tr>
<td>Solution preparation and administration</td>
<td>To wash hands with soap before/after gloves use;</td>
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<tr>
<td></td>
<td>To wear individual protective clothes, double gloves before working with HOD;</td>
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<tr>
<td></td>
<td>To use engineering control during solution preparation;</td>
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<tr>
<td></td>
<td>To follow the rules of drugs keeping and injection;</td>
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<tr>
<td></td>
<td>To perform intravenous injection of HOD in a separate, specially organized room;</td>
</tr>
<tr>
<td></td>
<td>To use catheters for HOD injection and preparation;</td>
</tr>
<tr>
<td></td>
<td>To throw away waste materials into containers.</td>
</tr>
<tr>
<td>Usage of Biological Protective Boxes (BPB)</td>
<td>To perform all preparative manipulations associated with HOD in BPB of II or III classes only;</td>
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<td></td>
<td>To use certain BPB with antiseptic aim;</td>
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<td></td>
<td>Not to use laminar flow units during work with HOD.</td>
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<tr>
<td>Clearing, deactivation, cleaning and wastes removal</td>
<td>To wear individual protective clothes before the work;</td>
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<tr>
<td></td>
<td>To clean working surfaces and equipment that contact with HOD periodically;</td>
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<tr>
<td></td>
<td>Accept as potentially dangerous: used bed-linen, clothes, biological excretions of patients at the oncological hospitals;</td>
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<td></td>
<td>To sort wastes according to current hygienic norms.</td>
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</table>

Table 3. Contraindications for medical staff at work with HOD

<table>
<thead>
<tr>
<th>Absolute contraindications</th>
<th>Relative contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of occupational disease</td>
<td>Suspected malignant growth</td>
</tr>
<tr>
<td>Presence of disability as a result of disease</td>
<td>HIV/AIDS, tuberculosis, hepatitis B.C</td>
</tr>
<tr>
<td>Malignant growth</td>
<td>Chronic eyes diseases</td>
</tr>
<tr>
<td>Pre-malignant condition</td>
<td>Chemical injuries consequences</td>
</tr>
<tr>
<td></td>
<td>Anemia, leucopenia, thrombocytopenia</td>
</tr>
<tr>
<td></td>
<td>Thyroid gland diseases</td>
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<tr>
<td></td>
<td>Benign neoplasm</td>
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</tbody>
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