

Prevention of reproductive health hazards at work

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Currently, knowledge on the potential reproductive toxicity of even rather common occupational exposures is limited. The role of occupational health personnel has been, in addition to pointing out possible reproductive hazards at the workplace, to search for information and disperse it to the workers. The common task of scientists and occupational health personnel is to evaluate what should be done on the basis of the results of research. The given knowledge can be implemented in regulations (legislation on the work environment, occupational exposure limits, occupational health and safety, protection of pregnant workers, occupational health care, etc), in the planning of workplaces and work, and in occupational health care. The scientific basis for assessing reproductive toxicity has been the target of discussions in many countries, also in the Nordic countries Denmark, Sweden, Norway, and Finland. A cooperative project of the Nordic countries had the purpose of formulating criteria for reproductive toxicity. The group suggested criteria on the basis of published experimental and epidemiologic data (1). The principles of the requirements and the interpretation of the data for such an assessment have been described elsewhere (2).

Proposal for Nordic criteria for classifying reproductive toxicants

In the Nordic criteria various aspects of reproductive health have been taken into account. Thus an agent can be classified as a reproductive toxicant if it causes damage to the genotype of the individual, disturbs the hormonal regulation of the reproductive functions, causes damage leading to decreased fertility in the reproductive organs, disturbs pregnancy or development or health (including childhood cancer) of the offspring or adversely influences lactation (2).

According to the Nordic criteria a substance can be classified as toxic to human reproduction (group 1 A) if reproductive toxicity has been shown in epidemiologic studies (more than one) in which chance and bias were reasonably excluded.

The substance should be regarded as toxic to human reproduction (group 1 B), for example, if it is plausible from human studies that the substance is a re-

productive toxicant, but chance and bias cannot be reasonably excluded, and the substance has, in addition, caused reproductive toxicity in at least one species of experimental animals.

A substance can be classified into group 1 B also if there is other evidence on reproductive toxicity in humans (case reports, toxicity data, etc) and, in addition, if the substance has caused reproductive toxicity in at least one species of experimental animals and when there is supporting evidence (eg, on mechanism of action, similarities in toxicokinetics or toxicodynamics) (2).

If the substance is shown to cause reproductive toxicity in two or more species of experimental animals, it is classified into group 1 B also. In the presence of sufficient supportive evidence (2) reproductive toxicity shown in two or more strains of one animal species is enough for classification into group 1 B.

A substance can be classified as possibly toxic to human reproduction (group 2) if it has caused reproductive toxicity in two or more strains of experimental animals. If two or more studies of the same strain of a single species have shown that there is no evidence indicating that the effects are strain specific, the agent can be classified into this group. In addition, if human data indicate that the substance is a reproductive toxicant but chance and bias cannot be reasonably excluded, a substance can be classified into this group.

An agent can be considered not classifiable as to its reproductive toxicity to humans (group 3) if it has been investigated, but cannot be classified into the previous classes, or if data are lacking.

These Nordic criteria form a proposal and have not yet been accepted as official rules in any Nordic countries. The use of these criteria remains to be established. An expert group of the European Community is developing respective criteria as well.

Legislative changes in Finland

In Finland the idea of preventing reproductive hazards at work has been integrated into legislation through two different types of laws. First, the act on occupational safety obliges the employer to ensure that work conditions are not likely to cause genetic damage to the worker and are not harmful to the offspring or to the reproductive health and pregnancy of the worker. A statute gives advice to the employer on how to achieve this goal and lists agents considered capable of causing such damage.

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Table 1. Occupationally used agents hazardous to the genotype, fetus, and reproduction (statute by the Ministry of Work in Finland).

Type of agent	Agent
Genotoxic	Benzene Epichlorohydrine Ethylene oxide Genotoxic antineoplastic drugs Styrene oxide Vinyl chloride Ionizing radiation, including radionuclides
Reproductive toxicants (affecting fertility, etc)	Dibromochloropropane Lead and inorganic lead compounds 2-Ethoxyethanol Ethylene dibromide Chloroprene Manganese 2-Methoxyethanol Carbon disulfide Synthetic estrogens and progestagens
Harmful during pregnancy	
Chemical	Carcinogens Anesthetic gases Mercury and its compounds Carbon monoxide Lead Cytostatic drugs Organic solvents Chemicals which, according to occupational and safety legislation or the law concerning chemicals, carry the warning sign R45 (mutagen), R46 (carcinogen) or R47 (teratogen)
Biological	Viruses: hepatitis B, herpes, cytomegalo, varicella, rubella, human immunodeficiency virus Bacteria: listeria Toxoplasma
Physical	Ionizing radiation, including radionuclides

Table 2. Exposure considered potentially harmful during pregnancy.

Agent	Recommended exposure limit or tasks considered not acceptable
Anesthetic gases	Halothane 1 ppm/8 h, 3 ppm/15 min in workroom air (Finnish occupational hygienic reference value) Nitrous oxide 100 ppm/8 h ^a Isoflurane, enflurane 10 ppm/8 h ^a
Inorganic lead	1.0 µmol lead · l ⁻¹ blood ^b
Mercury	50 nmol mercury · l ⁻¹ urine ^b
Cytostatic drugs	Preparing the solution for administration
Carbon monoxide	14 ppm/8 h
Organic solvents	10% of the Finnish occupational exposure limit
Carcinogens	Exposure in general
Ionizing radiation, including radionuclides	2 mSv on the abdominal skin (= 1 mSv in the fetus)

^a Because for this chemical there is no Finnish occupational exposure limit, the guidelines refer to the Swedish one.

^b The Finnish reference value for the exposure of the general population.

Second, the act on special maternity leave, which came into force on 1 July 1991, allows women who are exposed to agents considered to be harmful to pregnancy or the offspring to request a transfer to a safe job from the beginning of pregnancy. If such a job cannot be offered, the woman may be entitled to a special maternity leave and benefits. A special maternity allowance is paid by the National Insurance. The occupational physician is in charge of assessing whether the exposure is, according to the written guidelines, dangerous to the pregnancy or the offspring.

A statute deriving from the law on occupational safety advises the employer on how to achieve the goal. Improvements in work conditions and work organization and the selection of the safest possible materials are recommended as primary methods of prevention. Accompanying regulations list agents considered capable of causing genetic damage, of affecting the fertility of the male or female worker, and of being hazardous to offspring or to pregnancy (table 1). The agents accepted thus far have been reported to cause adverse reproductive effects in humans in at least two studies and thus meet the criteria of group 1 A of the Nordic proposal.

The regulations and guidelines accompanying the legislation on special maternity leave include a list of agents possibly harmful during pregnancy. Agents considered as possibly harmful are the same as those listed in table 1. In the selection of agents a rather strict criterion has been followed. Only chemicals whose harmful effects on the fetus or pregnancy have been shown in at least two well-conducted epidemiologic studies are included, along with chemicals with the warning sign R 45 (mutagen), R 46 (carcinogen), or R 47 (teratogen), given on the basis of occupational, safety, and chemical legislation. So far, lists of chemicals in R 45, R 46 or R 47 have not been published. Furthermore, not only the presence of the chemical in the workplace, but also the exposure level has to be taken into account in the assessment of the need of job transfer or special maternity leave. The guidelines also give suggestions of the level of the exposure considered harmful (table 2).

Exposure to agents causing contagious diseases such as toxoplasmosis, listeriosis, German measles (rubella), herpes, chickenpox (varicella), hepatitis, cytomegalo infection, and HIV (human immunodeficiency virus) infection can be considered harmful in certain work tasks or conditions. However, many workers have immunity to the usual viral children's diseases. Vaccination is recommended, when available, for workers in risk tasks. Otherwise hygienic work habits are enough in many work tasks, but there are some occasions on which a job transfer or special maternity leave may be needed for a nonimmune pregnant worker (eg, a varicella epidemic in a children's day care center). Much of the prevention in the health system, as well as in the children's day care and school systems, depends on how well informed the employees

and employers are. Occupational health personnel have the major role in distributing the information and planning the needed measures for individual workplaces.

Use of special maternity benefits

During the first half year that the law was in force, only about 50 applications were made. They mainly came from industry with organic solvent exposure as the reason for application. Some applications came from health care or the school system because of varicella epidemics in the workplace. In addition, veterinarians have made inquiries and in some cases also an application for a leave of absence.

The original estimation was that 500–900 women a year might need special maternity leave. At the moment, the benefits have been used very little. One reason may be a good and flexible situation which makes a transfer to a safe job possible in the workplace. Another reason may be the high unemployment caused by the economic recession during 1991 in Finland. The workers may also be insufficiently informed about the new legislation. If an enterprise has been closed, the workers cannot get special maternity leave. In Denmark, where similar legislation has been in force since 1981, 1.6% of the women who had given birth to a child in 1985 used the special maternity benefits because their work was considered possibly hazardous for the offspring (3). In Denmark the National Sickness Insurance also pays the benefits.

In Quebec, Canada, where such legislation has been in force also since 1981, about 1000 women used the possibility in 1981 and 12 000 (30% of working pregnant women) did so in 1988 (4). About 80–85% of the benefit claims are accepted in Quebec. In Quebec the benefits are paid according to the provisions of the act concerning industrial accidents and occupational diseases. In both Denmark and Quebec physical strain and heavy work are included in the legislation, whereas in Finland they are not.

In Finland there are about 60 000 births a year. If the situation would resemble that in Denmark, about 960 women should receive benefits annually. In Quebec the use of the benefit has increased, about 10% every year (5); such an increase may be the trend in the future in Finland, too.

Conclusions

In the prevention of reproductive hazards the sound solution seems to be to decrease the exposure of female and male workers to reproductive toxicants. Such a principle helps to avoid discrimination against women because of reproductive capacity. It is also reasonable because the reproductive health of male workers is also damageable. According to this principle the reproductive toxicity of occupational exposures should be taken into account when limits are set for permitted concentrations of chemicals (eg, occupational exposure limits) in the workroom air. The prerequisites for accepting a new chemical for use should be that it has been adequately tested for its possible reproductive toxicity and such toxicity has not been found.

References

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