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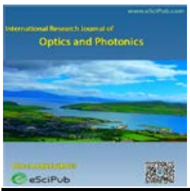

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The influence of radiation x germ cell and embryonic fetal development

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ABSTRACT

Objective: In this article the effects generated by ionizing radiation are discussed more precisely by X-rays, in the cells of gametic line and in embryonic/fetal development, when there exposition without proper protection for this type of energy. Methodology: The method used for preparation of this work was the literature review of scientific papers, theses and magazines found in the databases already available. Results and Discussion: Based on the literature review carried potential risks were analyzed and importance of radiation protection, in addition to their negligence consequences.

Keywords: Radiation Ionizing. Biological Effects. Radiation Tolerance. Germ Cells. Embryonic Development.

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INTRODUCTION

The medical use of radiation is the major source of exposure to artificial radiation and includes three distinct areas, radiology, radiotherapy and nuclear medicine. These medical radiation sources were started with the development of the first bulb X-ray by Roentgen in 1895 and since that time, contribute in a pivotal manner to the medical diagnosis and radiotherapy[1,2]. This use despite being widespread throughout the world, is not evenly, with significant variations between countries, especially in relation to the practice of radiology[3].

RADIATION X

Any discussion of the effects of ionizing radiation dispenses with a clear understanding of what is ionizing radiation and how it is measured (dosimetry). We can set it to high-energy electromagnetic waves (X-rays or gamma rays) that, when interacting with matter, triggers a series of ionization, transferring energy to the atoms and molecules in the irradiated field thus intracellular physico-chemical changes[4].

X-rays have specific properties which gives them the possibility of application in medical and industrial radiography, radiotherapy and research, namely, they have the ability to penetrate materials that absorb or reflect visible light, do fluoresce some substances, can produce a image on a photographic film, produce valuable biological changes in radiation and can ionize the gas[5].

BIOLOGICAL EFFECTS GENERAL

The process of interaction between tissues and radiation can cause changes and possibly cause cell death in extreme cases leading to death of the individual. The cells undergo changes that can lead to other cells change causing, as with cancer; sterilization[6].

The biological effects of radiation consist of the natural response of the body to an offending agent and does not constitute necessarily a disease, since the effects of the interactions of ionizing radiation with cells may arise directly, damaging a macromolecule, or indirectly, interacting with the environment and producing free radicals. These cellular modifications can be repaired by enzyme action, or generate biochemical injuries as premature cell death, change in cell division and genetic damage[7].

Thus, such responses are the result of the interaction of radiation with matter, and arise mainly be related to the genetic material, or associated molecules, which cause him irreversible or reversible damage, according to the cell repair system efficiency of the exposed individual .8)

Cells with high proliferation rate are the most sensitive to ionizing radiation, are found in high mitotic activity in those tissues or called quick response. The radiosensitivity is inversely proportional to the degree of cell differentiation and directly proportional to the number of cell divisions needed for the cell to reach its adult form. Therefore, the most radiosensitive cells are more deep layer of the epidermis, erythroblasts, bone marrow cells and immature forms of spermatozoa[4].

In certain cases, the consequences produced by X-rays show reversibility characteristics. Where functional changes are induced, these are temporary, followed by a more or less complete restoration. At the cellular level this power restoration seems to be related to the ability of the cell to form certain molecular buildings entering their complex. Other structures, due to its high degree of specialization and complexity, makes fallible's attempt resynthesis, thus causing irreversible effects. In this way, the restoration intervenes at all scales, with susceptible injuries partial restoration, other total restoration and still others as cell necrosis and cancerous affections, totally irreversible. (3)

The relationship between radiation dose and biological effect involves the knowledge that the dose exceeds a certain threshold, the threshold dose. This existence does not mean that there are no harmful effects when the dose is less than this threshold, because there are always ionization phenomena, with their chemical and biological consequences. Similarly always follows a lag time between the time of irradiation and the appearance of lesions, the time may be variable. (3)

The radiation can also be teratogens emergence motif when exposed to the embryo, this can occur when their mothers are required to perform a radiological examination, usually by clinically significant issues. Even with insignificant 5 rads of radiation in the pelvic region of mothers' where it is proven that nothing affects the developing human being, we need to use a lead blanket and avoid high exposure to energy. (9)

This review aimed to raise the influence of X-rays in the germ cells and embryonic and fetal development.

METHODOLOGY

The study is a systematic review of scientific literature, based on the search and preliminary bibliographic identification, summary BOOK REPORT, analysis and interpretation of material, bibliography, review and final report. The following databases based the literature: PORTAL CAPES, SCIELO, SCIENCEDIRECT, PubMed and MEDLINE. Data analysis was done by six people which initially obtained 50 articles that have been excluded through filters: cancer, effects of radiation, X-ray, radiosensitivity, radiology, women's, men's and pregnancy.

RESULTS AND DISCUSSION

The descriptors were used: "ionizing radiation", "germ cell", "embryonic", "biological effects," and "radiation tolerance". Results: Among the articles analyzed, 28 references were used for the construction of this approach.

A fabric may exhibit greater or lesser resistance to radiation, depending on the degree of differentiation of cells that constitute it. In an adult individual only a few tissues are composed of cells whose function is reset by successive divisions, cell populations whose average lifetime is of the order of one or two tens of days (formed elements of the blood cells and coating); the cells responsible for production of eggs and sperm also fall among highly vulnerable cells to the action of ionizing radiation by having, as a functional feature, a high rate of cell division[7].

Genetic Damage occurring after irradiation of testes and ovaries. Ionizing radiation can induce mutations in sperm and oocytes. These mutations may give rise to adverse effects on future generations[5].

The effects of radiation in the testicles depend on the playing field, the total dose and fractionation scheme. Even very low doses, such as those used in diagnostic radiological procedures such as plain abdominal X-rays and intravenous urography (0,1-0,2cGy), may cause mild and transient decreases in sperm motility, which appears about 2 months after irradiation[10].

According to the World Health Organization (WHO) so that a given sperm sample is considered abnormal, you must have at least one of the following assumptions: volume less than 2.0 ml; sperm concentration of less than 20 x 106 / ml; total count of sperm less than 40 x 106 per ejaculation; morphology with less than 30% normal forms; and lower mobility than 50% cells with anterograde progression quality less than 2, on a scale of 0 to 4, within a period of 60 minutes after ejaculation. With regard to mobility of sperm WHO defines four categories: rapidly progressive sperm, sperm slowly progressive, non-progressive sperm, and sperm immobile[11].

The direct irradiation in these gonads can cause oligozoospermia whose intensity is dose dependent. The gonadotoxicity is also influenced by fractionation, with the single dose of radiation is less deleterious than fractionated schemes. Small doses (ex. 10cGy) may cause oligozoospermia, which is usually transient. Doses ≥ 100cGy lead azoospermia, which tends to be permanent[10].

In the same way testes, ovaries, are the carriers of follicular cells and show, similar to the male germ cells, the radiation sensitivity. The risk of ovarian malignant degeneration isn't associated with a safe threshold and grows as the patient is exposed continuously to radiation (stochastic effect). The same reasoning applies to the risk of genetic alteration of the ovarian follicles and therefore the offspring of the patient. The risks of ovarian failure and clinically detectable skin lesions at the entry point of the beam of X-rays, however, occur after a predefined threshold of 400 and 200 centigrays (cGy), respectively[12,13,14].

Germ lines, corresponds to several generations of cells involved with the production of gametes. The consequences of irradiation of these lines vary according to the sex of the irradiated individual, which reflects the difference between the production of eggs and sperm production[7].

In genetic effects in the damage of the reproductive cells that participate in the process of Individuals who have been exposed to radiation, can result in blemishes or defects in their offspring individuals[15].

The probability of occurrence of genetic effect is dose dependent. Genetic Damage occurring after irradiation of testes and ovaries. The ionizing radiation can induce mutations in sperm and oocytes which could lead to harmful effects on future generations. Mutations occur as a result of structural changes in the DNA of germ cells. Hereditary diseases that can arise, vary in severity and may range from small metabolic and skeletal abnormalities, to severe mental problems and early death[5].

In women, the phase of intense proliferation of female germ cells (still in the fetal stage) is the most vulnerable to the action of radiation. Exhibits at this stage can compromise fertility. With the evolution of germ cells for primary oocytes (also in the fetal stage), the population of germ cells disappears and the possibility of replacement of this population and the other which they originate. In case of death of the cells of this line, there is the possibility of recovery of damaged populations. In men, sperm production is a process extremely vulnerable to the action of radiation because it involves a cell line in a constant state of proliferation. At every stage of the process cells may die. By contrast, the fact that the man maintain throughout his life primordial cells of male germ line guarantees that there is always the restoration of this line, in case of damage caused by exposure to radiation. In the case of a localized exposure, the man may have temporary drop in sperm production that lasts as long as the surviving primordial cells to recompose destroyed lineage. Sterilization of man by action of radiation is possible but involves exposure to extremely high doses[7].

Pregnant may need to undergo radiological tests for accurate diagnosis and adequate treatment. In these cases the exposure to ionizing radiation and its effects on the fetus are of concern to the patient and his doctor. Indeed, most of these tests is safe and offers significant risk to the fetus. However, it is important that the radiologist know the potential risks to be able to instruct everyone involved in care[16].

A particular concern in performing imaging using ionizing radiation on pregnant patients or breast-feeding lies in the potential risk to the fetus is exposed[17]. However, we must also take into account whether the mother's medical condition is life-threatening and the exam will help in its survival and in this case the fetus will also have a direct benefit[18].

Should be taken into account gestational age, physical condition of the patient and associated gestational disorders. Estimated to be also previously the radiation dose absorbed by the fetus based on the examination of desired protocol. [...] Radiological examinations should be done at institutions that can ensure the adoption of effective measures of radiological protection and have modern and regularly calibrated and checked equipment. The radiologist is usually the most prepared professional to assess the best diagnostic option in a given clinical situation, ensuring safety to the mother and fetus[16].

The biological effects from exposure to ionizing radiation by the fetus should be highlighted and can be divided into four categories: intrauterine death, malformations, growth disorders and development and mutagenic and carcinogenic effects[19].

The embryo is more sensitive to the effects of ionizing radiation in the first two weeks of pregnancy; during this period, the embryos exposed to radiation will remain intact or be resorbed or aborted[19,20].

During the 3rd and 15th week of gestation (when it occurs organogenesis), the damage in the embryo may be due to cell death induced by radiation, disturbance in cell migration and proliferation[19]. At this stage can result in severe abnormalities in central nervous system which is being formed (for example, hydrocephalus and microcephaly[16].

Another important effect of radiation exposure in the womb is the mental disability. This deficiency is a result of the proliferation, differentiation, migration and connection of neural cells at the moment that the tissue in question, cerebral cortex, is to be structured[22].

Between the 16th and 30th weeks of pregnancy the risk of mental retardation remain, inhibiting the growth of the fetus and microcephaly. After 32 weeks of gestation there is no significant risk to the fetus, except for a possible increased risk of developing a malignancy during childhood or adulthood[23].

Several studies have shown that when the uterus is subjected to even low doses (mGy 20) increases the risk of the fetus developing cancer in childhood, and particularly increases the risk of leukemia, by a factor 1.5 to 2, 0 when compared to the natural incidence B. (17,24,25) However, it is unclear whether this exposure should occur during pregnancy or can precede it[19].

The basic principles of radiological protection establish necessary conditions for operating activities using ionizing radiation should be adopted for the benefit of society, considering the protection of workers, the public, the patient and the environment[26].

Considering the current state of technological development and the experiences gained over the years, it uses specific rules and regulations for radiology, which once followed in practice, guarantee the standardization of minimum requirements for radioprotection, reducing radiation doses acceptable levels and providing security to users[7,27].

The more distant from the radiation source, the lower the intensity of the beam. The radiation intensity is proportional to the inverse square of the distance between the point and the source[26].

Personal protective equipment (PPE) is mandatory in radiology services according to the rules of the Health Surveillance. Among them we can mention: Pb glasses, thyroid Guard, Dosimeter TLD, Apron of Pb and Saiote of Pb. They are made with lead strips or be flexible when made of rubber enriched with chumbo.A thickness of protective aprons can range from 0.25 to 0.5 mm lead, due to the need for radiological protection. The gonad shield should be used in patients of reproductive age, if the line of the gonads is not near the primary irradiation field, so that no interference occurs in the examination[26].

Studies show that professionals and / or students of some hospitals or health centers there is negligence on the use / availability of all PPE required for the work in this activity. Not all individuals who have contact with ionizing radiation are used for individual radiation protection methods such as gonads protectors, thyroid, gloves, plumbiferous glasses, personal protective screen, among others, although the aprons are used by many what It demonstrates the need for investment in academic and professional health education in order to prevent injuries[28].

CONCLUSION

As noted in the analyzed references, exposure to X-radiation without proper radiation protection is a decisive factor for the quality of germ cells as well as fetal and embryonic development. In this case, the female germ line, the male germ line and the embryo or fetus may be adversely affected when exposed to this type of ionizing radiation without the necessary radiation protection.

It is essential that basic biosecurity conditions are met, in the practice of this practice, since the radiation protection is primarily designed to provide safe conditions for activities involving ionizing radiation. Acting thus with due responsibility and following the basic principles of radiation protection, the consequences harmful to embryonic and fetal processes can be attenuated and even reversed. Thus, not only individuals exposed to radiation would be free of the negative influence of such energy, as well as their descendants.

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