Volume 12, No 1 | International Journal of Radiation Research, January 2014

The challenging issue of pre-conception irradiation of parents: Are we walking in a dark road?

S.M.J. Mortazavi[1*] and H. Mozdarani[2]

[1]*Department of Medical Physics and Medical Engineering, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran*
[2]*Department of Medical Genetics, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran*

► ***Short note***

**** Corresponding author:***
Prof. SMJ Mortazavi,
Fax: *+ 98 711 2349332*
E-mail: *mmortazavi@sums.ac.ir*

Received: Oct. 2013
Accepted: Dec. 2013

Int. J. Radiat. Res., January 2014; 12(1): 79-80

Keywords*: Diagnostic radiology, radiation, spermatogenesis, pregnancy, risk.*

The increasing knowledge of adverse biological effects of exposure to ionizing radiation and development of molecular techniques allowing deeper insights into the mechanisms of radiation induced damage, led to controversial scientific debates regarding the effects of very low doses of ionizing radiation. There is a similar situation for exposure to chemical genotoxic agents in daily life. Therefore, nowadays the public is confronted with contradictory announcements of newly discovered health risks every day. As such, we read with great interest an article by Dr. Robert Brent entitled "Pregnancy and Radiation Exposure" which can be found online on the web site of the US Health Physics Society (HPS) (URL: http://hps.org/hpspublications/articles/pregnancyandradiationexposureinfosheet.html) [(1)]. In this article Dr. Brent states that "Because of the theoretical risks, we advise men who have had even diagnostic exposures to radiation to wait for at least two spermatogenesis cycles, which is about four months. While these very low exposures that occur from diagnostic radiological procedures are so low that there probably is not even a measurable risk, we still make this recommendation of waiting following the radiation exposure." On the other hand, in the fact sheet published by HPS entitled "Radiation Exposure and Pregnancy" (online at URL: http://hps.org/documents/pregnancy_fact_sheet.pdf) it is claimed that " There is no evidence that your future children will be at a greater risk for birth defects from X- rays or radionuclide medical tests that you receive before becoming pregnant [(2)]. This conclusion is based on extensive studies of women exposed to atomic-bomb radiation at Hiroshima and Nagasaki and those pregnant women who received x-ray studies, radionuclide medical tests, and other medical radiation procedures". In this light we can conclude that HPS experts believe that only men who have had even diagnostic exposures to radiation are advised to wait before conception. This concept is not in line with the report published by Signorello et al. who stated that "Our findings do not support concern about heritable genetic changes affecting the risk of stillbirth and neonatal death in the offspring of men exposed to gonadal irradiation. However, uterine and ovarian irradiation had serious adverse effects on the offspring that were probably related to uterine damage" [(3)]. Interestingly, ICRP-84 clearly states that "Prenatal exposure to ionizing radiation as used during most diagnostic procedures generally presents no increased risk of prenatal death, malformation or impairment of mental development (i.e. deterministic effects) compared to the background incidence of these entities [(4)]". Furthermore, according to ICRP "Pre-conception irradiation of either parent's gonads has not been shown to result in increased cancer or malformations in the children" [(4)]. In contrast with ICRP viewpoints, a report by Busby et al. indicates that "the current concept of dose thresholds-as high as

[Downloaded from ijrr.com on 2026-11-08]

100 mSv stated in ICRP 90 of 2003- does not appear to conform to the observational evidence in cases of chronic low-dose exposure" [5]. On the other hand, Nakamura et al. in a recent report stated that "past studies, primarily on the offspring of A-bomb survivors and childhood cancer survivors, did not indicate any transgenerational effect of parental exposures to radiation" [6].

We believe that members of the *general public will be confused* by these controversial viewpoints. Virtually all human activities especially when using modern technology, involve some associated risks. Using ionizing radiation in medical imaging is not exempt, although the level of dose received by patients' gonads is very low, sometimes lower than the natural background level. The linear no-threshold (LNT) dose response model proposed by most international agencies responsible for protection against ionizing radiation is now also controversial because of knowing a number of biological processes such as DNA repair, adaptive response and apoptosis which may modify molecular and cellular radiation induced damages at very low dose range [7]. Although transgenerational genome instability of ionizing radiation at higher doses of ionizing radiation (2- 4 Gy) is shown after paternal irradiation of experimental animals [8-10] however, there is no evidence as yet to show the adverse effect of very low dose ranges of diagnostic radiology received by testes either on spermatogenesis or embryogenesis. In fact the dose received by testes during diagnostic radiology is so low that cannot induce spermatogonial mitotic death or apoptosis, but the stem cell if damaged, may retain the unrepaired damage and pass to the next sperm generations. Therefore even awaiting two spermatogenesis cycle before conception might not help the damaged stem cells to repair. This type of recommendations might lead to increasing radio phobia in public and prevents people in need to make benefit from modern diagnostic radiologic procedures.

As the study of atomic bomb survivors has provided the majority of our information about the teratogenesis, carcinogenesis and mutagenesis caused by in-utero exposures in humans [11, 12], a system of revised evidence-based recommendations should be provided to clarify some of the current confusion. We believe that the best and simple way to avoid increasing public GSD (Genetically significant dose) is to encourage protection of gonads while doing radiography if possible and adhere strictly to ALARA.

REFERENCES

1. Brent R (2008). Pregnancy and radiation exposure. Health Physics Society.
2. HPS. Radiation Exposure and Pregnancy, Health Physics Society Fact Sheet, June 2010
3. Signorello LB, Mulvihill JJ, Green DM, Munro HM, Stovall M, Weathers RE, et al. (2010) Stillbirth and neonatal death in relation to radiation exposure before conception: a retrospective cohort study. *Lancet* ***376(9741)****: 624-30*.
4. Kal HB, Struikmans H (2002) Pregnancy and medical irradiation; summary and conclusions from the International Commission on Radiological Protection, Publication 84. Nederlands *Tijdschrift voor Geneeskunde,* ***146****: 299-303*.
5. Busby C, Lengfelder E, Pflugbeil S, Schmitz-Feuerhake I (2009) The evidence of radiation effects in embryos and fetuses exposed to Chernobyl fallout and the question of dose response. *Medicine, Conflict, and Survival,* ***25****:20-40*.
6. Nakamura N, Suyama A, Noda A, Kodama Y (2013) Radiation effects on human heredity. *Annual Review of Genetics,* ***47:*** *33-50*.
7. Mozdarani H (2012) Biological Complexities in Radiation Carcinogenesis and Cancer Radiotherapy: Impact of New Biological Paradigms. *Genes,* ***3:*** *90-114*.
8. Salimi M, Mozdarani H (2008) Reduction of transgenerational radiation induced genetic damages observed as numerical chromosomal abnormalities in preimplantation embryos by vitamin E. *Nukleonica,* ***53:*** *137-143.*
9. Mozdarani H, Nazari E (2009) Cytogenetic damage in preimplantation mouse embryos generated after paternal and parental gamma-irradiation and the influence of vitamin C. *Reproduction,****137:*** *35-43*.
10. Moghbeli-Nejad S, Mozdarani H, Behmanesh M, Rezaiean Z, Fallahi P (2012) Genome instability in AZFc region on Y chromosome in leukocytes of fertile and infertile individuals following exposure to gamma radiation. *J Assist Reprod Genet,* ***29:*** *53-61*.
11. Brent RL (1989) The effect of embryonic and fetal exposure to x-ray, microwaves, and ultrasound: counseling the pregnant and nonpregnant patient about these risks. *Semin Oncol,* ***16:*** *347-68.*
12. Blot WJ, Miller RW (1973) Mental retardation following in utero exposure to the atomic bombs of Hiroshima and Nagasaki. *Radiology,****106:*** *617-9*.

[Downloaded from ijrr.com on 2026-11-08]