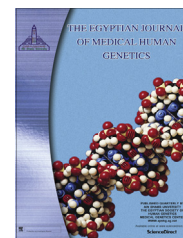




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REVIEW

Radioactive fallout and neural tube defects



Nejat Akar

TOBB-Economy and Technology University Hospital, Ankara, Turkey

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Spina bifida

Abstract Possible link between radioactivity and the occurrence of neural tube defects is a long lasting debate since the Chernobyl nuclear fallout in 1986. A recent report on the incidence of neural defects in the west coast of USA, following Fukushima disaster, brought another evidence for effect of radioactive fallout on the occurrence of NTD's. Here a literature review was performed focusing on this special subject.

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Neural tube defects, are one of the common congenital malformations, and mainly consist of closed or open Spina bifida. It is a prenatal failure of the embryonic neural tube to close over the spinal cord, leaving the cord unprotected by the bony cover and open to trauma and infection. Anencephaly is also a type of neural tube defect in which major portions of the brain and skull are missing, resulting in stillbirths or death within the perinatal period. Neural tube defects, which begin during the first month of pregnancy, have been reduced by increased intake of folic acid during pregnancy [1,2]. Further risk of anencephaly has been found to increase due to exposure to X-rays and neutrons in mouse zygotes [3].

The particular sensitivity of the fetus to radiation exposure, and the ability of radioisotopes to attach to cells, tissues, and

DNA raise the question of whether fetuses/newborns with birth defects with greater exposures suffered elevated harm during the period after the fallout. Until now, there were four radioactive fallouts during the last six decades i.e. Hiroshima and Nagasaki (1945), Marshall Islands (1952), Chernobyl (1986) and recently Fukushima (2011). Until Chernobyl, there was no report on the occurrence of NTD's following radioactive fallout. However post-Chernobyl observations identified elevated rates of neural tube defects in Turkey [4–11]. Then after from other countries such as Bulgaria, Croatia and Republic of Belarus [12–14].

Our prospective study in a Turkish province, Bursa showed that the hospital deliveries carried a high incidence of anencephaly and open Spina bifida (5.8 per 1000 total births) in 1983–86 period [4].

Further a radiological survey of 1204 members of the population of Bursa revealed a high prevalence of Spina bifida occulta (16.3%) [5].

E-mail address: nejatakar52@gmail.com

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In the first 6 months of 1987, however, there was an increase in incidence to 20 per 1000 births ($P < 0.01$). The possibility is raised that the Chernobyl disaster of May 1986 might have resulted in the elevation of the rate in an already susceptible population. During the last six months of 1987, the incidence of NTD decreased to 12.6 and that of anencephaly to 6.3 per 1000. During the first 6 months of 1988, the corresponding rates were 5.8 and 1.5 [6].

Following our reports, retrospective data from three different cities of Turkey (İzmir/Aegean Region; Trabzon/Black Sea region; Elazığ/East Anatolia) supported a peak increase and a gradual decrease over the same period [7–11].

There after Moundjiev et al. from Bulgaria, Lazjuk et al. from Republic of Belarus and Kruslin et al. from Croatia reported the same findings from their countries [12–14].

On the other hand, two consecutive reports in 1988 and 1999 from EUROCAT Working group did not confirm these findings for Europe [15,16].

Criticism for the studies reporting post-Chernobyl NTD increase, mainly focused on the data interpretation methods not reported fully; and data depending on several small hospital-based series [17]. In order to explain the discrepancy between these studies, we hypothesized the increase of NTD's after Chernobyl either by just a "coincidence" or already existing high incidence of NTD's in Turkish population [6].

Three decades after, the radioactive fallout in March 2011 Fukushima nuclear meltdown entered the U.S. environment within days; levels of radioactivity were particularly elevated in the five western states bordering on the Pacific Ocean [18].

Recently, Mangano and Sherman compared rates of five congenital anomalies including Spina bifida and anencephaly for 2010 and 2011 births from April–November in the five western states. The increase of 13.00% is significantly greater than the 3.77% decrease for all other U.S. states combined (CI 0.030–0.205, $P < 0.008$). For each of the five defects, they observed an increase from 2010 to 2011 in the five West Coast/Pacific states and a decline in the remaining states. However, none of the differences were statistically significant. The largest difference in the change of the two areas occurred for anencephaly (+41.24% vs. –3.13%) and for Spina bifida it was +13.8% vs –6.94% respectively [18].

In conclusion, we can say that recently reported data on the Fukushima disaster gives us not only an opportunity to better understand the effects of radioactive fallout but also gives us another evidence for the Chernobyl observations on NTD.

Conflict of interest

I have no conflict of interest. I declare that this "personal opinion" is not submitted to any scientific journal.

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