

Parental Occupational Exposures and Childhood Brain Tumors: Impact of Ionizing Radiation

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Commentary

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DESCRIPTION

Parental exposure to carcinogens in the workplace conceivably could cause increased risks of cancer in their children through several routes, including exposure that could damage the father's DNA prior to conception, parental maternal exposure that might directly impact the developing fetus, and postnatal parental exposure to infectious agents or chemical in the workplace they might remain on skin or clothing and subsequently expose the child. Elevated risk of childhood brain tumors was reported for parental work with paper and pulp; solvents; painting, printing, and graphics arts; oil or chemical refining; farming; metallurgy; and air and space. Negative findings have also been reported for employment in aerospace industries. Several studies of parental work with hydrocarbons have not shown positive association with risk of childhood brain tumors. Although there have been a few positive studies of pre-and postnatal maternal exposure, several other studies with any maternal exposure. Lack of specificity of exposure in the positive studies and inadequate numbers of exposed mother in the negative studies prevent meaningful conclusion. There have been consistent themes of elevated risk of brain tumors with parental employment in the motor vehicle-related occupations, the chemical and petroleum industries, and with frequent paint exposure.

Ionizing radiation

There is a strong increased risk of intracranial tumors following therapeutic ionizing radiation. Even with relatively low doses used to treat tinea capitis in childhood, relative risks of 18, 10, and 3, have been observed for nerve sheath tumors, meningioma, and gliomas, respectively. Cases of cerebral glioma decades after treatment for tinea capitis have been reported. Data that exist for atomic bomb survivors show an increased risk of meningioma for high-dose levels of exposure.

Studies showed an increased risk of brain tumors in children after prophylactic CNS radiation treatment for acute lymphoblastic leukemia. One study showed that the incidence of brain tumors among irradiated children with ALL was 12.8%. Interestingly, among children treated with cranial irradiation and intensive antimetabolite therapy for acute lymphocytic leukemia, those with germline polymorphisms leading to low or absent thiopurine methyl transferase activity were significantly more likely than those without such polymorphisms to develop brain cancer.

Parental exposure to ionizing radiation prior to conception has not been shown to be a risk factor for childhood brain tumors. The role of parental exposure to radiation in the etiology of childhood brain tumors is unclear. Japanese studies of atomic bomb survivors have not indicated increase brain tumor incidence among those exposed in utero. Although relative risks of childhood brain tumor in the range of 1.2 to 1.6 have been reported for parental radiation exposure, some of the studies had too small a sample size to achieve statistical significance. Furthermore, relative risks of this low magnitude associated with a comparatively uncommon exposure could not account for very many childhood brain tumors.

Evidence thus far does not strongly favour an important role for diagnostic radiation in glioma; relative risks of 0.4, 1.2, and 3.0 for exposure to dental X-rays were reported from three case-control studies that asked subject about their history of dental X-rays. The evidence is slightly stronger for meningioma; three of four studies have shown greater than twofold relative risks for exposure to dental X-rays, but later studies did not confirm this.

A small but significant elevated risk for brain tumors has been reported in studies of nuclear facility employees. Risks of the same magnitude have been reported for workers producing nuclear materials.

However, confounding or effect modification by chemical exposures makes interpretation of causality difficult. Mortality from brain tumors has been reported to be elevated in one study of airline pilots, possibly implicating exposure to cosmic radiation at high altitude in brain tumor risk. However, another study if pilots did not find an excess of deaths due to brain tumors.