

SCIENTISTS REPORT SURPRISE FINDINGS OF THYROID CANCER FOLLOWING CHERNOBYL

Reports of increased cancer are strikingly contrary to those of another group of scientists investigating the same problem at roughly the same time.

AN INTERNATIONAL TEAM of scientists studying the health effects following the Chernobyl nuclear accident claim that they have found a "great increase" of thyroid cancer among children from Belarus who lived within the most heavily contaminated zones around the disastrously failed reactor. They believe the onset of cancers started within four years of the accident—and in numbers far greater than thyroid cancers caused by radiation would be expected to appear based on conventional estimates of risk from exposure to radioiodine.

The reports of increased cancer, which appeared in the September 3, 1992 issue of *Nature*, are strikingly contrary to those of another group of scientists investigating the same problem at roughly the same time, whose study published a month earlier found no increase in thyroid abnormalities among people from highly contaminated settlements in Belarus, Russia, and the Ukraine. These researchers compared the incidence, prevalence, and characteristics of thyroid nodules among people from radiation-contaminated and uncontaminated areas four-and-a-half-years after the accident as part of the International Chernobyl Project sponsored by the International Atomic Energy Association. The study appeared in the *Journal of the American Medical Association* on August 5, 1992.

For several days following the April 26, 1986 accident, hundreds of millions of curies of radioactive iodines poured from the burned reactor (as



Photo courtesy James R. Hurley, MD

A Russian child is shown undergoing a palpation for thyroid nodules. These studies were performed as part of the International Chernobyl Project in 1990.

compared to the Three Mile Island nuclear accident, which released less than 20 Ci of the radionuclide). Scientists agree that it's reasonable to expect an increase of thyroid cancers caused by Chernobyl. The question is how soon and to what extent such increases might occur. Those who doubt the reported findings of elevated cancer rates say the evidence for such claims is inconclusive and at odds with currently accepted scientific beliefs about the carcinogenic potency of iodine-131 and the latency of radiation-induced thyroid cancer.

The IAEA's 1991 assessment of the health consequences of the Chernobyl accident found no health disorders that could be attributed directly to radiation, ruling out reports of widespread illnesses. What the investigators did find was "substantial negative psychological consequences" and stress-re-

lated illnesses attributed to uncertainty and fear extending beyond contaminated villages and towns.

Some critics of the reports of huge increases in thyroid cancer warn that if the findings have been overstated they could harm the local population by further stirring unwarranted fears. Worse yet, heightened concern could lead physicians and public health authorities to advocate excessive surgical interventions on children with thyroid abnormalities less threatening than the risks of surgery.

While acknowledging that the increase in thyroid cancer is unexpected, the investigators from the city of Minsk in Belarus, and another group coordinated through the World Health Organization, maintain that the increase is real and that it is evidence that the carcinogenic effects of radioiodine may be much greater than

previously estimated. These investigators have yet to publish their data in a peer-reviewed forum, nor have all of their data been presented for scrutiny.

Critics say that the evidence is too sketchy to warrant the conclusions made in the preliminary correspondence. "The data is interesting, but not conclusive—although there may be an increase, I don't believe this proves it," says Fred A. Mettler, Jr., MD, MPH, of University of New Mexico School of Medicine, the lead author of the earlier study that found no evidence yet of thyroid abnormalities.

Positive Findings

The researchers from Belarus base their claim of increased disease on reports of children diagnosed with thyroid cancer from 1986, the year of the accident, until the first half of 1992. Overall incidence of the disease rose from about four cases per year from 1986 to 1989, to 55 cases diagnosed in 1991, according to the report by Vasili S. Kazakov of the Ministry of Health of Belarus and co-authors. Around the city of Gomel alone, they report that the incidence of thyroid cancer went from one or two cases per year to 38 cases in 1991. Their report concluded that "the only realistic explanation for the increase in the frequency of thyroid cancer is that it is a direct consequence of the accident at Chernobyl."

Detractors, however, can think of numerous explanations for the appearance of increased cancer rates. All cancers, including thyroid cancer, may have been poorly recorded in Ukraine and Belarus prior to and immediately following the Chernobyl accident so that accurate reporting after the accident might reflect an apparent increase. Overall cancer rates reported for Belarus are about a quarter of those reported in Poland, according to Dr. Mettler. In his view, the baseline numbers of thyroid cancer in the reports from Belarus are too low. Rather than just an average of four cases per year, he would expect roughly 15 to 20 cases per year to normally arise in

a population the size of Belarus.

A related factor is the possibility of an "ascertainment bias"—when investigators set out to find any effect, the more carefully they look, the better their chances of finding it—in this case thyroid cancer following the Chernobyl accident. "If you weren't paying much attention to thyroid cancers and then suddenly started looking for this disease process that doesn't kill people right away, then you might come up with what looks like an increase," says Dr. Mettler. That is, many cases that

in normal circumstances might go unreported for years would be detected all at once early on. "There's no question that they are looking for thyroid cancer a lot harder," says Dr. Mettler.

"The number of thyroid cancers reported to central agencies has increased," says nuclear medicine physician Henry D. Royal, MD of the Washington University School of Medicine, a co-author with Dr. Mettler. But he thinks ascertainment bias is a large factor in that increase. Not only are physicians and their pa-

Dealing with Cesium

In the hours and days following the Chernobyl accident, clouds laden with radioactive iodine isotopes caused absorbed thyroid doses ranging from an average of 0.2-3.2 Gy to reconstructed doses as high as 30-40 Gy in some children. The possible consequences of these doses—excess thyroid cancers—are still subject to scientific debate. But further damage due to radioiodine contamination is no longer a danger, due to the short half-lives of radioiodines. Iodine-131 has a half-life of about 8 days, the other radioiodines from 1 to 21 hours.

Cesium-137 has a half-life of about 30 years, so contamination of locally grown food remains a threat to some populations. In most areas, authorities don't consider external exposures to the isotope a major risk. Through the International Chernobyl project, the International Atomic Energy Association is also evaluating the risks of internal exposures, for example, from breathing resuspended contaminated dust, which is believed to be a minor risk even for farm workers.

To prevent ingestion of cesium radioisotopes, many settlements in Belarus, Ukraine and Russia ban the consumption of locally produced food. In some areas such bans may be overly restrictive, according to IAEA scientists. "Doses actually received due to the ingestion of contaminated foodstuffs were substantially lower than the prescribed intervention levels of dose, typically by a factor of 2-4, and as a consequence foodstuffs may have been restricted unnecessarily," the IAEA reported last year. "Relaxation of the criteria for foodstuffs should be considered as a preferable alternative to relocation" the report said, given the profoundly detrimental health, social and economic effects of large-scale relocations.

In areas where cesium contamination remains a hazard, the IAEA and the United Nations Food and Agricultural Organization (FAO) have asked the governments of Belarus, Ukraine, and Russia to provide a technique using the compound ferric ferrocyanide, or Prussian blue, to cut cesium levels in milk and meat.

Cesium, after ingestion by cattle grazing on contaminated fields, is excreted by the hepatobiliary system into the gut where some is reabsorbed and some is excreted. Prussian blue binds to cesium, thus preventing reabsorption and promoting faster excretion.

The IAEA and FAO recommendation follows 18 months of field trials with Prussian blue compounds in areas around Chernobyl. Cattle treated with the compound were shown to absorb a third of the cesium absorbed by untreated cattle. Scandinavian authorities have also used the Prussian blue technique to deal with cesium contamination from Chernobyl.

Rapid introduction of Prussian blue would help reduce health risks, according to the IAEA, especially for children, since up to 90% of childrens' internal radiation doses due to cesium come from milk.

According to the IAEA, more than 200,000 people live on small farms that remain dependent, for economic reasons, on the milk from family-owned cattle. Protective measures typically taken at collective farms have not been available to many of the small farms. Such measures include deep ploughing of contaminated fields, increased fertilizer use, decontamination of pastures, abandonment of affected fields, and strict monitoring and rejection of contaminated produce.

tients more alert to thyroid disease after Chernobyl, he says, they are also taking greater advantage of improved methods of detection, including ultrasound machines donated by other countries.

The WHO scientists flatly deny that ascertainment bias could have played more than a minor role in the recorded increase in thyroid cancer. What led the researchers to rule out this bias were their data showing a high proportion of thyroid nodules that turned out to be malignant, combined with the aggressiveness of the malignancies, according to Keith Baverstock, PhD, a radiation scientist with WHO's European Centre for Environment and Health, and lead author of one of the reports in *Nature*. Dr. Baverstock also says that world-wide cancer registries show that the incidence of thyroid cancer in children under age 15 is on the order of 1 per million. But the numbers he's seen for the Gomel region of Belarus show an incidence of about 80 per million per year. "That really is a staggering degree of under-ascertainment if that much is going undetected."

The study by Dr. Mettler's group is itself evidence against the positive reports of cancer. Their study compared the thyroid exams of some 1060 people who were sampled by age and geographic region. The researchers included adults and children aged 5 and 10 years old, all of whom underwent sonographic examinations as well as thyroid palpation. To isolate populations likely to have been exposed to radioiodine, the researchers went to seven villages with soils highly contaminated by windborne cesium-137, in excess of 555 kBq/m². As a control, the investigators examined people from villages with less than 37kBq/m² measured on the ground.

Contrary Evidence

Their findings: no significant difference in the number and size of thyroid nodules of people living in highly contaminated villages compared with those living in control villages—or

Women Who Chose to Abort

Perhaps the least noticed but well-documented health consequence of the Chernobyl accident is the upsurge in abortions that followed in southern Europe.

In the five months following Chernobyl, as many as 7,800 abortions of wanted pregnancies may have been performed in Italy, according to a paper published last year (Spinelli A, Osborn JF: Effects of the Chernobyl Explosion on Induced Abortion in Italy. *Biomedicine & Pharmacology* J 6: 243-247, 1991).

Prior to the accident, doctors reported about 15,000 abortions per month in Italy (induced abortions in the first 90 days of pregnancy are available free under Italian health system, but physicians are required to report all procedures). Using four different models to predict the expected number of abortions per day based on data from the previous year, the authors calculated an estimate of the number of "excess" abortions per day after Chernobyl.

In the five months following the reactor accident, the mean excess per day varied from 20 to 52, depending on the model—amounting to an estimated total of 3,000 to 7,800 excess abortions in addition to the expected 75,000 abortions. Researchers have observed a similar phenomenon in Greece.

Fear of birth defects likely influenced the decision of many of these women to abort. "This fear may or may not be justified, wrote the authors of the Italian study. "It is, however possible to suppose that the publicity given to the potentially harmful effects would lead some women who would otherwise have carried their pregnancy to term, to opt for an induced abortion."

Radiation safety experts say the risks from radiation in Italy and Greece did not warrant widespread abortions. Physicist John Cameron, PhD, at the University of Wisconsin, points out that levels of radiation from Chernobyl (in committed effective dose equivalents for the first year after the accident) ranged from 0.3 mSv in the southern Italy to 0.6 mSv in the north, according to studies by the Government Protection Board of Italy. The doses are comparable to a month or two of additional background radiation. "We can assume that the increase in abortions following the accident was due to an unfounded fear," Dr. Cameron wrote in a letter to the Health Physics Newsletter.

"I gravely doubt that any abortion was necessary," says David Brill, MD, chief of nuclear medicine at Giesinger Medical Center, Danville, PA. "There was an overreaction to a perception of danger rather than to a reality."

compared with published studies of unexposed populations in other countries. "That's not to say there won't be an increase in some populations around Chernobyl in years to come," says Dr. Royal. "But it would be surprising if we could measure an increase at this point."

Endocrinologist Jack Robbins, MD, of the National Institute of Diabetes, Digestive, and Kidney Diseases, points out that the Mettler study may have been performed just as increases in cancer began to occur and that if the researchers went back now they might find evidence of more cancers. Because the reports of increased cancer were localized in the Gomel region of Belarus, they could have slipped through the wider net cast by the Mettler study, which spanned regions from Belarus to Ukraine.

The study population may have been too small to detect any increases

in the disease among children. "The numbers in the Mettler study are too small—thyroid cancer is a pretty rare disease," says epidemiologist Roy Shore, DrPH, of the New York University Medical Center, who has closely studied the incidence of thyroid cancer among populations exposed to radiation.

Significant Tumors

As for the likelihood of the positive cancer findings, Dr. Robbins says that a "significant number of children have had significant tumors, probably more than were occurring in the population in previous years, and probably more than could be accounted for by increased surveillance. But there's not enough evidence to draw a conclusion."

In view of evidence gleaned from years of previous studies, Dr. Royal says that "the letter in nature is com-

pletely at odds with our current estimates of cancer risks.”

What scientific consensus there is on the radiation risks of radioiodine derives from a substantial number of studies of people ranging from the survivors of the atomic bomb attacks on Hiroshima and Nagasaki, to patients treated with ¹³¹I. In one survey of over 35,000 patients treated with diagnostic doses of ¹³¹I in Sweden, researchers found no increase in thyroid cancer after ten years. In a recently reported study of children exposed to radioactive fallout from testing of nuclear weapons at the Nevada Test Site during the 1950s, detectable increases in thyroid cancer didn't occur until 30 years after exposure, and even then the eight thyroid cancers only achieved statistical significance as an excess when lumped together with the incidence of benign thyroid nodules.

Other studies have established that the latency period for thyroid cancer following radiation exposure is about 5 years, according Dr. Shore, who recently systematically reviewed the subject.

Existing Dogma

Dr. Baverstock admits surprise that excessive numbers of advanced thyroid cancers afflicted children in less than five years after the Chernobyl disaster, but he believes the increases are real and call for a departure from the “existing dogma.”

Others think the surprising findings point out how slim the evidence from Belarus is. “When you come up with something significantly different from the wealth of published data, you've got to keep looking before drawing conclusions,” says Dr. Mettler.

Part of the resistance to the findings of cancer is based on studies that suggest that ¹³¹I doesn't cause increases of any kind in thyroid cancer, says Dr. Shore, “but the data have been awfully slim on children—and we know from other studies that children are more sensitive than adults to radiation.” He says that the use of ultrasonography,

and the ever-present worries of a population concerned with cancer have certainly created an ascertainment bias in measuring the incidence of thyroid cancer. But he adds that “some of [the cases of thyroid cancer] may well be a real excess.”

“The data so far are fully consistent with the idea that ¹³¹I is not terribly carcinogenic,” says Dr. Baverstock. He believes that shorter lived radioisotopes of iodine, and external exposures to radiation associated with the initial plume might best explain the findings of thyroid cancer. He says that the screening program that detected increased in thyroid cancer in Gomel failed to detect increases in the Mogilev region, even though estimated thyroid doses due to ¹³¹I were comparable. The initial radioactive plume drifted over Gomel, but not Mogilev. “That the same people are reporting increases in Gomel but not in Mogilev suggests that ¹³¹I is not the cause,” says Dr. Baverstock.

The unresolved debate over the incidence of thyroid cancer could have consequences on efforts by officials in Belarus and Ukraine to deal with anticipated thyroid disease. “One of the concerns people have is that the morbidity of looking for thyroid disease may be greater than the cancer itself,” says Dr. Royal. Diagnosis of thyroid cancer requires either fine needle biopsy or surgical removal of suspected neoplasms, which raises the possibility that people will be subjected to surgery unnecessarily, perhaps by their own demand once told of the possibility of cancer.

Balancing Risks

“There is no agreement as to how aggressively one should be looking for cancer, but looking too aggressively has some risks,” says Dr. Royal. Among them are the usual risks of anesthesia, which even for fine needle biopsies is considered necessary with young children. Thyroid surgery is an intricate procedure with a number of risks—including nerve and parathy-

roid damage—that are even greater with children.

National Institutes of Health in Washington convened a meeting in September partly to address concerns about the management of suspected thyroid cancer in the areas affected by Chernobyl. Dr. Robbins, who organized the meeting, says that after the reports of large numbers of children with thyroid cancer in Belarus and Ukraine, he saw a “need for improvements in communications among experts.” He invited surgeons, endocrinologists, and pathologists from the regions around Chernobyl to meet with their counterparts from the U.S.

One thing everyone has agreed on is the need for detailed epidemiological studies. The WHO has been seeking funding to carry out a long-term study following children who were exposed to radiation from Chernobyl. The National Cancer Institute is involved in a separate effort.

Epidemiology Needed

Nuclear medicine physician David Becker, MD, of New York Hospital and Cornell Medical Center, who is organizing that effort, says a final protocol is being worked out with the government of Belarus. A fixed cohort of 15,000 children will be followed for decades and efforts will be made to reconstruct radiation doses. Support is expected from NCI, the U.S. Department of Energy, the U.S. Nuclear Regulatory Commission, and agencies and facilities in Belarus. Dr. Becker says a similar joint effort with Ukraine is possible, but no agreements have been reached. While further studies will take decades to bring to light a full accounting of the consequences of the Chernobyl disaster, these studies should reveal in as few as five years if an early and pronounced increase in thyroid cancers afflicting the children of Chernobyl is real or an artifact of ascertainment bias.

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