Brain Risk Seen in Sickle Cell Kids

A new study indicates that children with sickle cell anemia, already at risk of life-threatening infections and strokes, may also suffer significant neuropsychologic deficits. The researchers find that children inheriting the red blood cell disorder have lower IQs and more learning disabilities than do their siblings without the disease – perhaps as a result of subtle brain damage during their first few years of life.

The study is small and awaits verification – some of which may come from a federally funded trial now getting underway. If confirmed, the findings could radically alter the prevailing view of sickle cell pathology in children, which today generally attributes any lag in school progress to the psychological stresses and missed school days common among youngsters with the disease.

The research, described in the December PEDIATRICS, is the first published report on the topic since a 1963 study found no significant intellectual differences between sickle cell children and controls. But according to Andrea V. Swift, who led the new study, unpublished data hint that the gap between the two groups has widened during the past two decades. She notes that cognitive scores have remained stagnant in sickle cell kids as a group, while increasing in controls. Because the disease primarily strikes blacks, Swift's team suggests that improved educational opportunities for blacks in recent years may make cognitive differences in afflicted children more apparent.

Swift, then at the University of Georgia in Athens, used a palette of standard psychological tests to measure cognitive abilities in 21 children, 7 to 16 years old, with sickle cell anemia and no known history of neurologic disease. She compared their scores with those of siblings within the same age range who did not inherit the disease. The sickle cell group scored significantly lower than the control group on almost all cognitive measures, report Swift and her colleagues from the University of Georgia and the Medical College of Georgia in Augusta. For example, full-scale IQ scores measured by the Wechsler Intelligence Scale for Children averaged 94.3 in controls and 77.7 in the sickle cell group.

"These are not kids that are scoring lower because of missing class or being hospitalized a lot," says Swift, now a school psychologist in Augusta. "The two groups of children really are different in measures of intellectual ability and achievement."

The researchers remain uncertain about the cause of these deficits. But the similar degree of impairment seen throughout the age range suggests the problem occurs early in development, they say – perhaps within the first year or two, when red blood cells begin producing the abnormal hemoglobin characteristic of the disease (SN: 12/2/89, p.360). "Maybe there is something metabolic going on that's not providing the best environment for brain development when the brain is developing very rapidly," Swift says.

The team found no significant cognitive deficits in children with sickle cell trait – a mostly asymptomatic condition in those inheriting one abnormal and one normal hemoglobin gene. Nonetheless, says study coauthor George W. Hynd, the new findings hint that all preschoolers inheriting even one sickle cell gene should be carefully evaluated and followed over the years for signs of intellectual delay that might respond to early educational intervention.

A three-year National Institutes of Health study should clarify and refine Swift's findings, says Daniel J. Burbach, a clinical psychologist at Duke University Medical Center in Durham, N.C. The multicenter study will include brain scans capable of identifying minor structural abnormalities that may provide clues to the source of any cognitive deficits.

– R. Weiss

Study upgrades radiation risks to humans

Low doses of X-rays and gamma radiation pose a human cancer risk three to four times higher than previously estimated, according to a National Research Council (NRC) report due out in January. Its findings – representing the first major reevaluation of radiation's human hazards in a decade – also indicate some fetuses exposed to radiation face a higher-than-expected risk of mental retardation. In the same report, a follow-up of atomic-bomb survivors indicates radiation's ability to induce serious genetic damage is somewhat *smaller* than suggested in animal studies.

Researchers presented the newly revised estimates this week at a Washington, D.C., symposium and will publish them in the NRC's fifth report on the biological effects of ionizing radiation ("BEIR V"). The estimates reflect an additional 14 years' worth of data (primarily on 76,000 Japanese atomic-bomb survivors) that were unavailable to the "BEIR III" panel in 1980. In addition, "BEIR V" researchers used a different risk model to extrapolate from high doses to low ones.

"BEIR III" suggested that low doses of ionizing radiation – those in the range of 1 to 10 rads – posed less cancer risk per unit of exposure than did far higher doses. The new report, however, suggests lower-dose exposures are proportionately just as potent as higher-dose exposures in inducing human cancers other than leukemia, says William H. Ellett, staff director of the "BEIR V" panel. Substituting a linear dose-effect relationship for the earlier "linear/quadratic" model increased the apparent carcinogenicity of low-dose exposures by a factor of 2.5, Ellett says.

Recently reduced estimates of the neutron exposures suffered by survivors of atomic explosions over Japan also contributed to the upgraded potency of certain forms of ionizing radiation. Neutron radiation – the most biologically hazardous – "no longer appears to be of major importance" in those Japanese exposures, according to the new report. This observation underlies the increase in the lifetime cancer risks now attributed to any given dose of gamma radiation.

One cancer for which the revised bomb-survivor data played an especially important role was leukemia. Here, even though the radiation-risk model that best fits the data remains a linear/quadratic one, the panel found the leukemia-induction risk of low-dose exposures to be four times higher than that reported in "BEIR III."

The new report estimates that exposures of 0.1 rem per year throughout a person's lifetime might contribute an average of 550 excess deaths from cancer per 100,000 people exposed – provided each year's exposure occurs in one single dose. Such exposures are comparable to those of a head-and-body CAT scan. "BEIR V" data suggest that if the same total dose is delivered as several smaller exposures – as from radon in the home – the cancer risk might fall to 300 excess deaths per 100,000 persons exposed, Ellett notes.

Overall, the estimates indicate that per unit dose, childhood radiation exposures carry roughly twice the lifetime cancer risk of adult exposures. Researchers also observed a dose-dependent incidence of retardation in Japanese children receiving fetal exposure to atomic-bomb blasts – but only if exposure occurred between the 8th and 25th weeks of gestation, and particularly between weeks 8 and 15.

– J. Raloff