A Perspective on Radiation Exposures to Pediatric CT Patients

Compared to conventional x-rays, patients receiving CT scans will receive higher doses of radiation. However, just because a *dose* is higher does **not** mean that the *risk* from this exposure is higher.

The average CT scan will deliver a dose of a few rem to the affected part of the body. By comparison, the radiology technologists and radiologists receive a comparable amount of radiation exposure year after year. Epidemiological studies on radiologists and x-ray techs have shown there is no apparent increase in cancer incidence from this exposure. In addition, the guidelines for fetal radiation exposure (if a woman receives a CT while pregnant) state that there is no medical reason to terminate a pregnancy for any exposure of less than 5 rem. It is true that children are more sensitive to radiation than adults are, but developing babies are more sensitive yet. This suggests that pediatric exposure in this range should be safe, too.

Finally, the calculations of risk from radiation exposure are just that – calculations. The Health Physics Society has specifically stated that it is not appropriate to calculate an expected cancer risk from any exposure of less than about 10 rem because of the great uncertainties in our calculations. The International Radiation Protection Association has stated that it is not appropriate to calculate an expected increase in cancer incidence across a large population resulting from relatively low levels of exposure to a large number of people. In other words, by trying to calculate the number of pediatric patients who might develop cancer as a result of CT scans, the authors of the American Journal of Roentgenology study have neglected the recommendations of two of the most prestigious radiation safety organizations in the world.

Some comparisons

Given the above, we can try to make some comparisons between the radiation received during a CT scan and some other activities. Please remember that these comparisons are not 100% accurate because there are differences between, say, obtaining a CT scan of a child's head and receiving a similar dose to the whole body.

Most CT scans will give a dose of about 1-5 rem to the scanned part of the body. By comparison:

- Residents of Ramsar, Iran receive an annual whole-body exposure of from 2-30 rem every year of their lives from natural background radiation. The incidence of cancer in Ramsar appears to be the same as in other parts of Iran.

- Many radiology personnel receive from 1-5 rem annually for most of their working lives. Studies have shown that radiologists are no more likely than the rest of the population to develop cancer.

- Workers in the nuclear power industry and military nuclear power programs receive from 1-5 rem annually, many of them beginning in their late teens. Great Britain and the US have conducted studies of workers in the nuclear power industry, including nuclear shipyard workers that have shown no increase (in some cases a decrease) in cancer among these workers.

Many other comparisons can be made. However, I think that the single most important things to remember are:

1. Humans have been working with radiation for over 100 years. In that time, we have learned a great deal, including the fact that exposure to low levels of radiation is safe. It is safer than driving by far, and poses less risk of premature death than home accidents, working in a government job, or falling to name just a few[1].

2. Just because something is considered "safe" does not mean it is entirely free of risk. We can choke to death eating a piece of steak, but most people consider eating steak to be a safe activity. Similarly, people consider living at home to be safe, but there are many injuries at home from falling, faulty wiring, and so forth. By saying that this level of radiation exposure is "safe", I mean that it is no more risky than many other things we voluntarily do daily that we consider to be safe.

3. The risk of not having a medically-indicated CT scan are far greater than the risks associated with this level of radiation exposure.

4. The models by which risks were calculated in the AJR papers are just that – models. They are **not** reality; they are the way that researchers in 1990 and 1991 tried to approximate reality. Since that time, these models have been questioned extensively, to the extent that respected professional organizations have recommended not using these values at low levels of exposure.

5. However, even if we accept the results of these papers (the worst-case scenario), the added risk is **still** very, very small.

This document was researched and written by the University of Rochester's Radiation Safety Officer. The information was gathered from the scientific literature, all of which was subject to extensive review by knowledgeable scientists and physicians prior to publication.

[1] These values are from "Catalog of Risks extended and Updated" by Bernard Cohen, Health Physics 61, pp 317-335, 1991. They are in comparison to a lifetime radiation exposure of 5 rem.