Lessons Learned from the Workshop on "Thermal Aspects of RF Exposure" in Terms of Revision of the RF Guidelines

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A workshop held in Gaithersburg, Maryland, in January 2010 was entitled "Thermal Aspects of Radio Frequency Exposure". It addressed the state of science on tissue-specific temperature effects. In view of the coming revision of the radiofrequency (RF) guidelines, by ICNIRP in particular, it is worthy to learn from this workshop about the thermal aspects of RF exposure in terms of setting guidelines, in view of the fact that local exposure limits have a rationale that may be outdated. One of the conclusions of the workshop was that basic restrictions should be based on well defined but not severe health effects.

Papers and reviews from the workshop will be published in the International Journal of Hyperthermia.

Some of the key lessons learned from the workshop are outlined below and will be discussed at the meeting:

Dose

Results of hyperthermia investigations are often expressed as a function of thermal dose, which is not defined as expected $\Delta T\, \Delta t$, but rather as CEM43, i.e., the duration in minutes of cumulative exposure at 43°C, which is equal to $\Sigma\, \Delta t\, R^{(T - 43)}$, with R = 0.5 for T > 43°C and 0.25 for T < 43°C. However, the question is still open of whether effects may depend on the rate of change of temperature and not only upon the cumulated dose.

Beneficial effects

Hyperthermia may be a powerful adjuvant of the immune response. This is now better documented and it appears that moderate heating (ca. 39.5°C) triggers beneficial immune responses. This observation is likely to be related to the fact that animals look for warm environment when they have infection.

Deleterious effects

Thermal damage to the tissues is mainly caused by protein denaturation or aggregation. No direct damages to DNA are expected.

Children

The potential greater sensitivity of children to RF exposure is a well-known current matter of public concern. The workshop consensus was that, in terms of responses to heat load, there are very few differences between adults and children, but a lack of knowledge for children less than 9 years of age.

Extrapolation to new signals

In view of the quasi consensus on the thermal nature of the observed biological effects, many scientists and stakeholders have suggested that the extrapolation could be done on the basis of the known thermal mechanisms and that temperature elevation be a better metric than SAR[1] in terms of basic restriction. However, this consensus is being challenged in view of a few positive laboratory findings and in the absence of a clear conclusion coming from epidemiology.

Moreover, public and governmental concern can lead to some pressure onto funding agencies and scientists to perform research on any new signal, which may not be needed.

Questions related to extrapolation and the needs for signal-specific research are thus:

- Is the knowledge on bioeffects of 2G signals adequate for health risk assessment?
- Can these data be extrapolated to 3G and other signals without implementing all the biological testing done with 2G?
- Can these two questions be translated into: "is the thermal mechanism the only one relevant to RF bioeffects?" If yes, does it allow for concluding that long-term low-level exposure is not a concern?
- Are we thus ready to move to temperature elevation to replace SAR in terms of basic restriction? What is the advantage of doing so?
- Should we take into account the public concern about new signals up to the point of performing systematic studies on new signals? Where would the funding come from?

More open questions related to thermal effects

- Are there delayed effects of acute thermal exposure?
- Could some thermal effects "hide" nonthermal effects?
- Is there a role of the TRPV[2] receptors in RF bioeffects?
- What constitutes a firm scientific basis for local exposure limits?
- Can one assign specific thermal threshold to the various organs? What should be the metric?

[1] Specific absorption rate
[2] Transient Receptor Potential Vanilloid, sensitive to heat