DEBATE treatment planning & thermometry

G. Van Rhoon[1] vs. A. Szasz[2]
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A.S. has a possible conflict of interest:

- founder & CSO of company Oncotherm (1988)
- chair, professor, lectureship Biophysics at St. Istvan University
- lectureship Bioelectromagnetics at Pazmany Catholic University
- lectureship Fractal-physiology at Chiba University (Japan)

Thermometry (A. Szasz)

Thermometry is mandatory in the heating techniques where

a. the absorbed energy is not known (there are lot of energy losses), so the temperature guesses the absorbed energy in the target
b. it is for safety – avoid the risk to overheat the healthy tissues (like surface, deep hotspots, etc.)

The dose

a. It has to be proportional with mass and other extensive parameters, unlike temperature
b. The correct thermal dose is the absorbed energy (kGy=J/g), like in ionizing radiation

The task of the dose is presently upside-down

When we measure the temperature we may transform it to real dose: energy

Planning software (A. Szasz)

It is a necessary tool in the methods of heating techniques is external beam radiation with request of isodose in the target. Planning shows:

1. **how much energy is absorbed**
2. **where the energy is focused**
3. **maximizes the heating in tumor and minimizes the hot-spots in untreated regions**

Need of planning depends on the applied technique.

Like no planning necessary for

- brachy-therapy,
- ablation therapies,
- intraperitoneal hyperthermic chemotherapy,
- whole-body hyperthermia
- etc.

The technique decides about the request of planning software

Oncothermia does not need it

Theses for oncothermia technique (A. Szasz)

The absorbed energy is the dose. Its unit is the kGy=J/g

Realization:

1. Don't be isothermal (no homogeneous heating)
2. Heat the malignant cells selectively
3. Use high heating efficacy, less energy-loss

When the above conditions are realized, then:

Use adaptive treatment protocol instead of planning

1. regulate the process by actual site and stage of the disease
2. expand the local treatment to systemic (immune effects)
3. be adaptive for patients' complaints

Challenges of the hyperthermia dose → CEM43°CT_x (A. Szasz)

a. The concept is based on the thermal **necrosis**, which is incorrect

b. Estimation of **heterogeneities** (Tx) is very rough, and its concept is not dose-like

c. CEM43°CT_x is incorrect: T has unit [°C]; what is the unit of $\mathbf{R^{(T-43°C)}}$?

d. The CEM43°CT_x dose is calibrated **in vitro** (Sapareto & Dewey)

e. The **kink of Arrhenius** plot essentially depends on the complementary applications

f. Development of Arrhenius-law, the **Eyring reaction-kinetics** has to be applied

WBH

- heats everything homogeneously
- the extreme temperatures can be reached
- the CEM°$43T_{100}$ is definitely higher than at any local treatment