

POSTER PRESENTATION

Open Access

Thermal dose and radiation dose comparison based on cell survival

Meredith Lee^{1*}, David Schlesinger², Gail ter Haar³, Benjamin Sela¹, Matt Eames¹, John Snell¹, Arik Hananel¹, Neal Kassell¹, Jason Sheehan², James Lerner², Jean-Francois Aubry⁴

From Current and Future Applications of Focused Ultrasound 2014. 4th International Symposium Washington, D.C, USA. 12-16 October 2014

Background/introduction

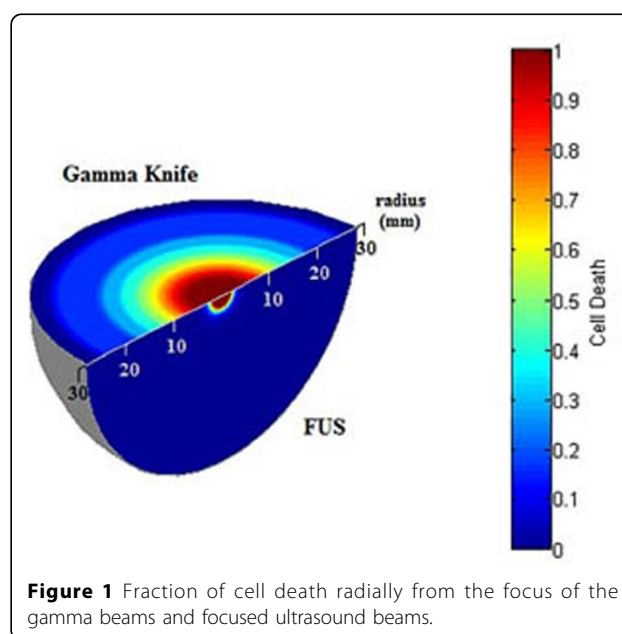
The biologic dose response curves of thermal dose and absorbed radiation dose have not been compared to each other even though they have both been extensively investigated separately and combined. Although heat and radiation produce cell kill by different biological mechanisms (Thermal dose denatures proteins and the radiation dose causes DNA damage) a comparison of dose response curves is possible using the endpoint of cell survival.

Methods

Survival curves for both thermal and radiation doses were extracted for three different types of cells from previously published data. Using models based on the beam shapes of the current clinical systems for the dose profile, the survival curves were generated and the survival profiles were compared for both modalities, Focused Ultrasound (FUS) and Gamma Knife (GK), for a thalamotomy. The thermal dose profile was calculated according to Dewey (1994), from temperature maps simulated with a 3D finite differences time domain code solving the bio-heat equation with a heat deposition term dependent on the pressure field. Radiosurgery dose distributions were exported from the Gamma Knife treatment planning software (Leksell GammaPlan versions 8.0 - 10.1, Elekta AB, Stockholm) with the smallest target as an input.

Results and conclusions

The comparison showed that focused ultrasound exhibits a steeper dose and survival profile than gamma knife. As shown in Figure 1, a smaller percentage of cells are dead a short distance away from the FUS target compared with GK. Also, cell death drops more gradually for GK



than FUS. Our results establish that the penumbra is steeper for FUS than GK and have implications for making treatment decisions as well as for rationally combining the two modalities.

Acknowledgements (Funding)

Focused Ultrasound Foundation

Authors' details

¹Focused Ultrasound Foundation, Charlottesville, Virginia, United States.

²University of Virginia, Charlottesville, Virginia, United States. ³The Institute of Cancer Research, London, United Kingdom. ⁴Institut Langevin, Paris, France.

¹Focused Ultrasound Foundation, Charlottesville, Virginia, United States
Full list of author information is available at the end of the article

Published: 30 June 2015

Reference

1. Dewey W: Arrhenius relationships from the molecule and cell to the clinic. *International journal of hyperthermia* 1994, **10**(4):457-483.

doi:10.1186/2050-5736-3-S1-P26

Cite this article as: Lee *et al.*: Thermal dose and radiation dose comparison based on cell survival. *Journal of Therapeutic Ultrasound* 2015 **3**(Suppl 1):P26.

**Submit your next manuscript to BioMed Central
and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit

