

FLOW MEASUREMENTS IN THE PORTAL VEIN DURING PART BODY HYPERTHERMIA

J. Gellermann, Ch. H. Cho, B. Hildebrandt, J. Göke, M. Deja, P. Wust
Charité Medical Center, Berlin, Germany

Introduction

On-line thermometry of part body hyperthermia (PBHT) is difficult especially by non-invasive measurements. Because until now a stable MR-thermometry has not been established in the upper abdomen due to respiratory motion and susceptibility artefacts, we attempted to utilise physiological changes during PBHT. With flow measurements in two slices in a specific orientation we can obtain information about the blood flow in the portal vein within a breath-hold.

Material and Methods

We performed flow measurements in 22 patients treated with PBHT (71 heating sessions) using the SIGMA-Eye applicator under MR control. We used a gradient echo sequence with velocity encoding (VENC) gradient and corrected phase images. In the magnitude images regions of interest (ROIs) were manually segmented to evaluate the mean velocity in the phase images. In the cross section (lumen) through the portal vein (perpendicular to the flow direction), the mean velocity and the flow (area times velocity) are sampled and correlated with other treatment parameters measured during PBHT.

Results

The diameter of the portal vein is reduced during power exposition, whereas the mean velocity does not change in a specific direction. The flow also decreases during power on and recovers after power off. Circulation parameters such as the product of heart rate times blood pressure (RPP) correlate with the decrease of the flow. Interestingly, patients who developed intolerances during a heat treatment (obliging the physician to reduce the power) show a particularly small cross section of the portal vein in measurements in close temporal connection. Complementary measurements of the liver blood flow using another technique (extraction of a dye from the blood after passing the liver and documenting the decreasing rate of this dye) support these findings.

Discussion

In the general opinion perfusion increases in normal tissues during hyperthermia. However, for the liver we found a decrease of perfusion during PBHT. The peripheral vasodilatation (to regulate the systemic temperature) might stress the cardiac output so much that a perfusion reduction in the visceral region becomes necessary. Dysregulation by (over)heating of neurovegetative structures, e.g. the celiac ganglion, might be another explanation. These findings prompted us to modify the timing of the cytostatic drugs during PBHT. Now, the start of the chemotherapy infusion is rescheduled to an earlier time, i.e. at least 15 min before power on.

Key-words:

Part body hyperthermia, flow measurement, perfusion regulation