

RELATION BETWEEN BODY SIZE AND TUMOUR TEMPERATURES DURING LOCOREGIONAL HYPERTHERMIA OF OESOPHAGEAL CANCER PATIENTS

P.M.A. van Haaren¹, M.C.C.M. Hulshof¹, H.P. Kok¹, S. Oldenburg¹, E.D. Geijzen¹,
P. Fockens², D.J. Richel³, J.J.B. van Lanschot⁴, J. Crezee¹

Dept. ¹Radiation Oncology, ²Gastroenterology, ³Internal Medicine, ⁴Surgery, Academic Medical Center, University of Amsterdam, The Netherlands

Introduction

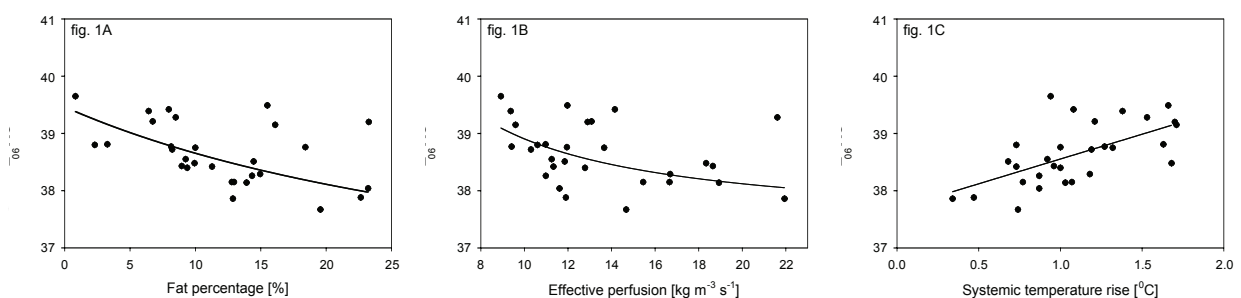
There is a correlation between thermal dose and clinical outcome for hyperthermia treatments. To achieve a sufficiently high and uniform temperature rise in the tumour is therefore important, and remains a challenge in clinical hyperthermia. Purpose of this study was to analyse the prognostic value of patients body size parameters for the tumour temperatures achieved during locoregional hyperthermia in patients with oesophageal cancer.

Patients and Methods

Since August 2003, 29 patients were treated with 5 weekly locoregional hyperthermia sessions combined with chemoradiotherapy, prior to surgery. Hyperthermia was given using the 70 MHz AMC-4 waveguide system. Temperatures were measured at tumour location in the oesophageal lumen using multisensor thermocouples, and expressed in terms of T_{90} , T_{50} and T_{10} and averaged over the 5 weekly hyperthermia sessions. Systemic temperature was monitored rectally. Effective tumour perfusion was estimated from the temperature decay at the end of treatment, which comprises contributions of perfusion, conduction and cooling by lungs and large blood vessels. Patients dorsoventral and lateral diameters and fat layer thickness at tumour level were determined using a CT-scan made in treatment position. Body mass was determined prior to each hyperthermia treatment session. As global parameter describing the patients body size we estimated the cross sectional fat percentage from diameters and fat layer thickness.

Results

Tumour temperatures (T_{90} , T_{50} , T_{10}) were inversely related to all body size parameters. For example, an increase in fat percentage from 0 to 25% yielded a decrease in temperature rise of ~ 1.5 °C (figure 1A). However, all body size parameters (body mass, estimated fat percentage, diameters and fat layer thickness) were mutually strongly correlated, emphasizing the importance of a single prognostic parameter describing the patients body size. Apart from that, tumour temperatures were inversely related to effective tumour perfusion (figure 1B), and proportional to systemic temperature rise (figure 1C), which are, however, not very useful as prognostic indicators, since they are on forehand unknown. Multivariate correlation analysis showed that, from all body size parameters, estimated fat percentage was the most significant prognostic factor for the achieved tumour temperatures. The combination of the three parameters fat percentage, effective tumour perfusion and systemic temperature rise accounted for $81 \pm 12\%$ of the variance in temperatures.



Inverse relations were found between tumour temperatures during locoregional hyperthermia and patients body size parameters, of which fat percentage proved the most significant prognostic factor for the achieved tumour temperatures. These findings could be of influence on inclusion criteria for new hyperthermia studies.

Supported by Dutch Cancer Society grant 2002-2622.