Abstract:

Inspiratory hyperoxia under hyperbaric conditions has been shown to effectively reduce tumor hypoxia and to improve radiosensitivity. However, applying irradiation (RT) under hyperbaric conditions is technically difficult in the clinical setting since RT after decompression may be effective only if tumor pO2 remains elevated for a certain period of time. The aim of the present study was to analyze the time course of tumor oxygenation and perfusion during and after hyperbaric hyperoxia. Tumor oxygenation, red blood cell (RBC) flux for perfusion monitoring, and vascular resistance were assessed continuously in experimental rat DS-sarcomas by polarographic catheter electrodes and laser Doppler flowmetry at 1 and 2 atm (bar) of environmental pressure during breathing of pure O2 or carbogen (95 % O2 + 5 % CO2). During room air breathing, the tumor pO2 followed very rapidly within a few minutes the change of the ambient pressure during compression or decompression. With O2 breathing under hyperbaric conditions, the tumor pO2 increased more than expected based on the rise of the environmental pressure, although the time course was comparably rapid. Breathing carbogen, the tumor pO2 followed with a slight delay of the pressure change, and within 10 min after decompression the baseline values were reached again. RBC flux increased during carbogen breathing but remained almost constant with pure O2, indicating a vasodilation (decrease in
vascular resistance) with carbogen but a vasoconstriction (increase in vascular resistance) with O2 during hyperbaric conditions. Since the tumor pO2 directly followed the environmental pressure, teletherapy after hyperbaric conditions does not seem to be promising as the pO2 reaches baseline values again within 5-10 min after decompression.