Abstract:
Inspiratory hyperoxia reduces tumor hypoxia, which is responsible for limited radiosensitivity of tumors. However, very little is known about the heterogeneity of intratumoral oxygenation during this supportive treatment. The study analyzes whether local hypoxia is still present during normobaric and hyperbaric inspiratory hyperoxia and whether the addition of CO₂ to the inspiratory gas affects the spatial pO₂ distribution. Tumor oxygenation of experimental DS-sarcomas in rats was assessed by polarographic needle electrodes at 1 and 2 atm (bar) environmental pressure during pure O₂ or carbogen (95 % O₂ + 5 % CO₂) breathing. Up to 320 individual pO₂ measurements were performed in a strictly oriented grid resulting in an oxygenation profile in a horizontal tumor layer. In the experimental tumors used the oxygenation showed pronounced heterogeneities with closely adjacent hypoxic and oxygenated regions. This heterogeneity was still visible under normobaric hyperoxia where large confluent hypoxic regions were detectable. At 1 atm, the addition of CO₂ improved tumor oxygenation significantly (at least in large tumors). At 2 atm, only very small local regions of hypoxia were detected. However, under this condition hypercapnia had no impact on tumor oxygenation. The data show that even under hyperbaric hyperoxia, hypoxic regions are detectable despite the average pO₂ increased by a factor of 100. The results also clearly indicate that the
oxygenation pattern improves disproportionally with increasing environmental pressure.

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