

ABSTRACT SECTION

1. Out-of-Field Cell Survival Following Exposure to Intensity-Modulated Radiation Fields

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Purpose

To determine the in-field and out-of-field cell survival of cells irradiated with either primary field or scattered radiation in the presence and absence of intercellular communication.

Methods and Materials

Cell survival was determined by clonogenic assay in human prostate cancer (DU145) and primary fibroblast (AGO1552) cells following exposure to different field configurations delivered using a 6-MV photon beam produced with a Varian linear accelerator.

Results

Nonuniform dose distributions were delivered using a multileaf collimator (MLC) in which half of the cell population was shielded. Clonogenic survival in the shielded region was significantly lower than that predicted from the linear quadratic model. In both cell lines, the out-of-field responses appeared to saturate at 40%–50% survival at a scattered dose of 0.70 Gy in DU-145 cells and 0.24 Gy in AGO1522 cells. There was an approximately eightfold difference in the initial

slopes of the out-of-field response compared with the α -component of the uniform field response. In contrast, cells in the exposed part of the field showed increased survival. These observations were abrogated by direct physical inhibition of cellular communication and by the addition of the inducible nitric oxide synthase inhibitor aminoguanidine known to inhibit intercellular bystander effects. Additional studies showed the proportion of cells irradiated and dose delivered to the shielded and exposed regions of the field to impact on response.

Conclusions

These data demonstrate out-of-field effects as important determinants of cell survival following exposure to modulated irradiation fields with cellular communication between differentially irradiated cell populations playing an important role. Validation of these observations in additional cell models may facilitate the refinement of existing radiobiological models and the observations considered important determinants of cell survival.

2. Organ Preservation With Daily Concurrent Chemoradiotherapy Using Superselective Intra-Arterial Infusion via a Superficial Temporal Artery for T3 and T4 Head and Neck Cancer

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Purpose

To evaluate the therapeutic results and rate of organ preservation in patients with advanced head and neck cancer treated with superselective intra-arterial chemotherapy via a superficial temporal artery and daily concurrent radiotherapy.

Methods and Materials

Between April 2002 and March 2006, 30 patients with T3 or T4a squamous cell carcinoma of the head and neck underwent intra-arterial chemoradiotherapy. Treatment consisted of superselective intra-arterial infusions (docetaxel, total 60 mg/m²; cisplatin, total 150 mg/m²) and daily concurrent radiotherapy (total, 60 Gy) for 6 weeks.

Results

The median follow-up for all patients was 46.2 months (range, 10–90 months). The median follow-up for living patients was 49.7 months (range, 36–90 months). After

intra-arterial chemoradiotherapy was administered, primary site complete response was achieved in 30 (100%) of 30 cases. Seven patients (23.3%) died. Using the Kaplan-Meier method, 1-year, 3-year, and 5-year survival rates were 96.7%, 83.1%, and 70.2%, respectively, while 1-year, 3-year, and 5-year local control rates were 83.3%, 79.7%, and 73.0%, respectively. Grade 3 or 4 mucositis occurred in 20 cases (66.7%). Grade 3 toxicities included dysphagia in 20 cases (66.7%), dermatitis in 6 cases (20%), nausea/vomiting in 2 cases (6.7%), and neutropenia and thrombocytopenia in 1 case (3.3%). No osteoradionecrosis of mandible and maxillary bones developed during follow-up.

Conclusions

Intra-arterial chemoradiotherapy using a superficial temporal artery provided good overall survival and local control rates. This combination chemoradiotherapy approach can preserve organs and minimize functional disturbance, thus contributing to patients' quality of life.

