Cytotoxicity of Electro-Surgical Smoke Produced in an Anoxic Environment

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BACKGROUND: The effect on cell viability of smoke produced during high-frequency electro-surgery has not been previously reported. The aim of this study was to produce smoke in vitro, in a closed environment similar to that encountered in minimal access surgery, and to test its cytotoxic effects on cultured cells.

METHODS: Pig liver was cut repeatedly with an electro-surgical hook knife, and the smoke generated was collected and equilibrated with cell culture medium. MCF-7 human breast carcinoma cells were exposed briefly to various dilutions of this medium and tested for clonogenicity.

RESULTS: Electro-surgical smoke produced in a helium environment reduced the clonogenicity of the MCF-7 human breast carcinoma cells in a dose-dependent manner, falling to 30% when the cells were exposed to undiluted medium for 15 minutes.

CONCLUSIONS: We conclude that electro-surgical smoke is cytotoxic. The sublethal effects at lower dilutions are currently being investigated.

30% with undiluted smoke. As the effects of the carrier gas (helium) alone were minimal, we conclude that one or more chemical components of the smoke itself were responsible for the observed cytotoxicity.

The findings of this study have shown that electro-surgical smoke resulting from the pyrolysis of tissue in a closed anoxic environment is clearly cytotoxic to a cultured cell line. The conditions of the experiment reproduced those encountered during MAS. The data indicate the need for efficient and prompt evacuation of smoke, not just to improve the endoscopic view but also because of its toxicity. There is also the possibility for as yet undocumented sublethal effects of electro-surgical smoke (in very low dilutions) on the cellular components of the immune system and on capillary endothelium that may promote tumor implantation during MAS. These are currently being addressed in further experiments.

REFERENCES