Targeting the cell cycle by cold atmospheric plasma.

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CAP (cold atmospheric plasma) is a technology, which is based on quasi-neutral ionized gas (plasma at low temperatures), which is being evaluated as an alternative or addition to existing cancer therapies. A recent study shows that CAP treatment can cause a significant reduction in tumor size in vivo. Thus the purpose of this study is to begin to identify the mechanism by which cancer cells are killed by CAP.
The studies were performed on normal and transformed epithelial cells. The impact of CAP on cells was evaluated through cell migration studies (microscopy time lapse studies of cells), cell cycle studies using flow cytometry, and viability studies using MTT assays. In addition, cells were synchronized to the same stage of the cell cycle using nocodazole and DNA damage after CAP treatment assessed by evaluating expression of the S-phase damage reporter phospho-histone yH2A.X.
It was found that normal and transformed cells respond differently to CAP treatment. Using a mild CAP treatment, it was observed that migration of normal cells was reduced ~30% ($p<0.001$). While aggressive carcinoma cells showed also decreased their migration rates after CAP (~20% with $p<0.001$), less aggressive papilloma cells did not ($p>0.05$). Flow cytometry studies show that CAP induces a robust G2/M-cell cycle arrest in both types of carcinoma and papilloma cells (double fold increase in G2/M phase in ~24 hours after CAP treatment). Normal epithelial cells showed a more modest cell cycle arrest.
Experiments show a G2/M arrest is induced by CAP treatment in two different types of cancer cells. These data support the hypothesis that the increased sensitivity of cancer cells to CAP treatment is caused by differences in the distribution of cancer cells and normal cells within the cell-cycle. Because more cancer cells are actively proliferating, more are in the S-phase of the cell cycle. Data show that cells in the Sphase are more vulnerable to CAP treatment.