Selective ablating urologic cancers with cold atmospheric plasma

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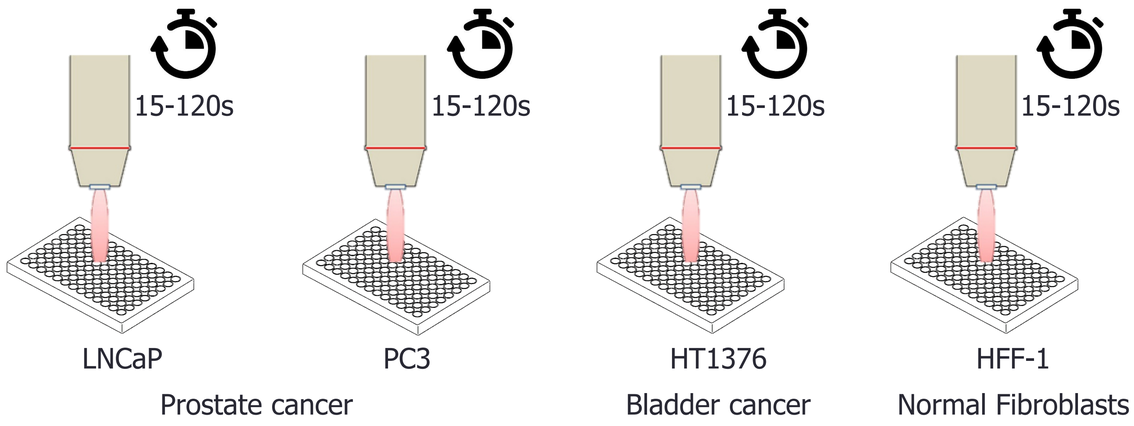
INTRODUCTION

- Prostate and bladder cancers are the first and fourth most common noncutaneous cancers in men in developed nations
- Plasma is also called the fourth state of matter
  - Ionized gas composed of reactive species, electrical and excited particles
- Cold plasmas recently came into the attention of medical society due to its non-inflammatory selective ablative effects in tumour cells
  - Their effects result from different interactions between plasma components with specific structural cell elements as well as cell functionalities
  - Their selectivity of action results from the lower antioxidant defenses of tumor cells and the cell cycle block at phase G2/M in rapidly multiplying cells
- Plasma therapy is still a developing field, but it seems to be effective against a wide range of tumors – melanoma, glioblastoma, breast, colon, lung and cervix cancer
  - Little is known about its role in the treatment of urologic neoplasms
- **Goal:** The aim of this work was to evaluate the cytotoxicity of cold atmospheric plasma (CAP) in prostate and urinary bladder cancer cell lines

MATERIALS AND METHODS

- Our group developed an electronic device capable of generating high output voltage that can ionize a significant fraction of air particles producing cold atmospheric plasma (CAP)
- Cell lines - plated in a concentration of 50.000-100.000 cells/mL in 200pL of cell culture medium
  - Prostate adenocarcinoma - LNCaP and PC3
  - Urinary bladder carcinoma - HT1376
  - Phenotypically normal human fibroblasts cell line - HFF-1
- The device was designed to expose cell cultures seeded in multiwell plates to short periods of CAP
  - Range from 15 to 120 seconds



- Metabolic activity (MA) and protein content (P) were assessed with colorimetric assays MTT and SRB, respectively

RESULTS

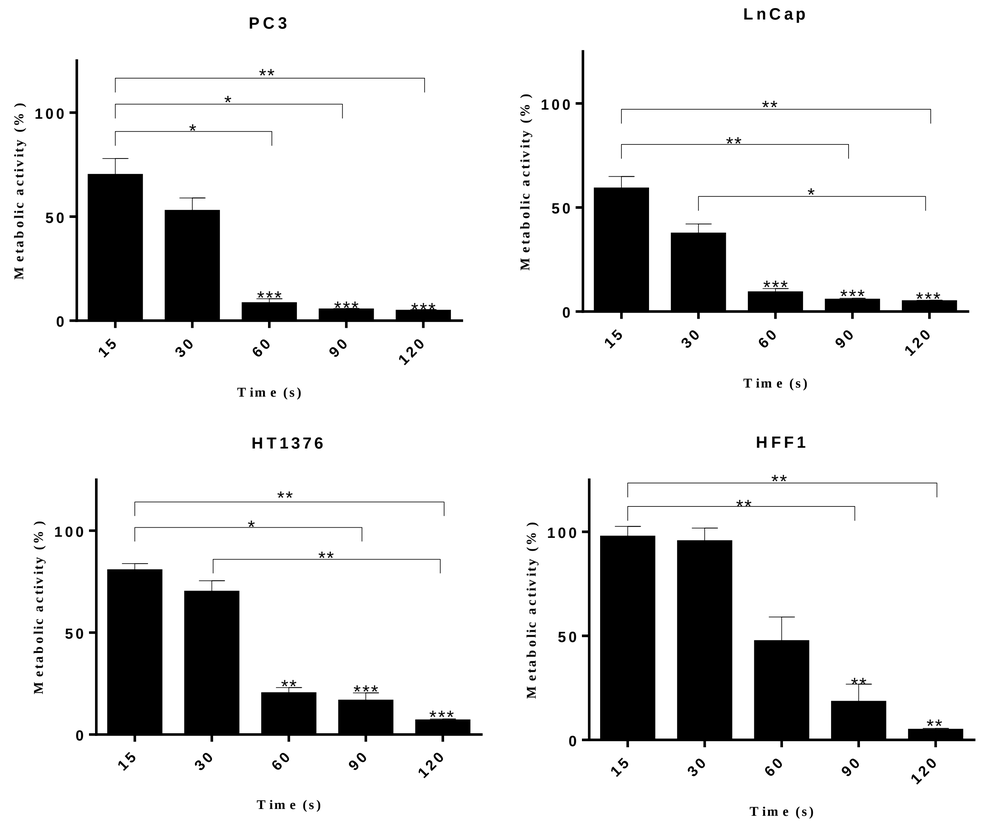


Figure 1 - MTT assay results 24 h after plasma therapy application in different human cell lines: prostate adenocarcinoma (PC3 and LNCap), urinary bladder carcinoma (HT1376) and fibroblasts (HFF1) at distinct times: 15, 30, 60, 90 and 120 seconds (s). Results are expressed as percentage of metabolic activity normalized to control.

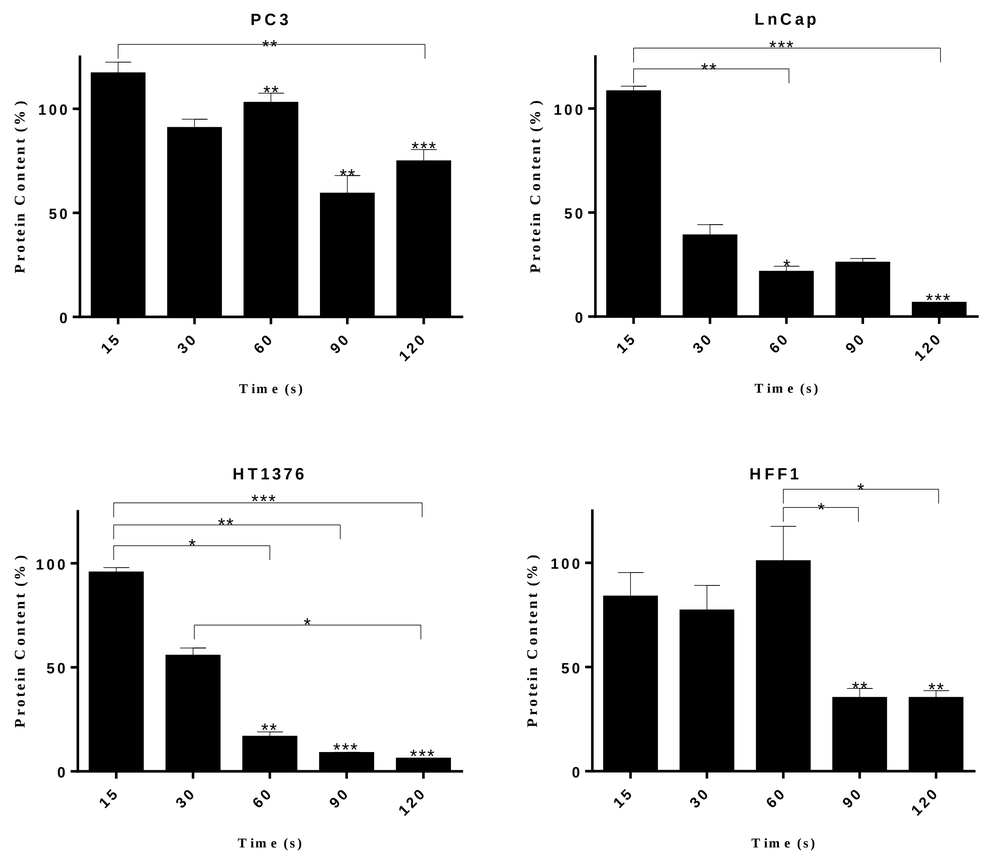


Figure 2 - SRB assay results 24 h after plasma therapy application in different human cell lines: prostate adenocarcinoma (PC3 andLNCap), urinary bladder carcinoma (HT1376) and fibroblasts (HFF1) at distinct times: 15, 30, 60, 90 and 120 seconds (s). Results are expressed as percentage of protein content normalized to control.

DISCUSSION

- CAP is effective on LNCaP and HT1376 cells – over 90% decrease in metabolic activity and protein content after only 60s of exposure
- Regarding to PC3 prostate cancer cell line, there was a decrease in metabolic activity after 60 seconds similar to the other two tumor lines, but the protein content did not have the same reaction even with 120s of exposure
- For the same exposure conditions, there was less change din metabolic activity or protein content of the normal fibroblast line
- CAP may offer a selective anti-tumour therapy capable of providing ablation of tumours after short time courses, typically in the range of seconds-minutes, without damaging with adjacent normal tissues
- Further studies are needed to determine the utility of CAP in the treatment of bladder and prostate cancer

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