Photodynamic Therapy for Cancer Treatment
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BME 281 First Presentation, October 8, 2016 <mujeneza@my.uri.edu>

Abstract—Although lasers and light have been known for their therapeutic properties for many years, the use of lasers in the treatment of cancer, primary Photodynamic therapy (PDT), is an emerging modality for the treatment of cancer. This paper will serve to give a brief introduction to and overview of PDT use for cancer treatment.

I. INTRODUCTION

CANCER is the second leading cause of death in the United States today. Studies show that one in four people are at risk of dying from some form of cancer independent of invasive site. (1) There are many different types of cancers and thus many different methods of treatments. Treatments include surgery, chemotherapy and radiation therapy. In the last twenty-five years, a new method of treating cancer was introduced. The treatment is known as Photodynamic Therapy (PDT). PDT is based primarily on the combination of a specific type of light or laser that activates a photosensitizing drug which in turn produces free radicals or active oxygen thereby killing targeted tissues and cells. (4,5)

II. METHODS

The first step in PDT treatment is the selection and injection of the photosynthesizing agent into the blood stream. The agent is then absorbed by the body and overtime (approximately 24 to 72 hours after injection) the agent remains longer and only in the cancer cells allowing for immediate and accurate identification of the tumor. (6) Subsequently, the agent within the tumor is activated when it absorbs energy from a light source at an appropriate wavelength. Which in turn generates a molecular form of oxygen called singlet oxygen that is true cytotoxic agent. Figure 1 below shows the mechanism of the PDT process.

(7) During this process a cycle of singlet-oxygen production can occur since the agent can be regenerated. Resulting in multiple different mechanisms of tumor cell destruction. The PDT photosensitizer can directly target the tumor, it can destroy surrounding blood-vessels, starving the tumor of oxygen-carrying blood. (7) This in turn alerts the immune system to attack the tumor. Figure 2, below shows how the localization of the specific tumor, proving the efficacy of PDT method to accurately identify the tumor, and decreasing the probability of damaging nearby healthy cells. The locale of the tumor was determined by the combination of the photosensitizer, and confocal laser scanning microscopy (5). The light source can be a laser or a different source. Laser light can be directed and delivered through fiber optic cables. In order to be able to activate the photosensitized the laser light must be a specific wavelength, this determines how far the light can travel into the body (6). For this reason, specific combinations of laser light and photosynthesizer must be used to treat different areas of the body.

III. RESULTS

PDT is still in its clinical trial for oncology uses. Considering there exist many different types of cancers, located in many different parts of the body, and that the patient themselves react differently to treatment, it is taking a considerable amount of time to produce accurate results of this method of treatment. Also the FDA has yet to approve other photosensitizing agent for use in PDT. Currently, it has approved the photosensitizing agent called porfimer sodium, or Photofrin® for use in treating and relieving the symptoms of esophageal cancer and non-small cell lung cancer. “In 2003, the FDA approved porfimer sodium for the treatment of precancerous lesions in patients with Barrett esophagus, a condition that can lead to esophageal cancer.” (6)

IV. DISCUSSION

Current studies have shown that PDT works just as well as chemotherapy or surgery for certain cancers (3). Some of the advantages include; no long term side effects(unlike chemo), precise and with little to no scaring, and less costly than other methods. Some disadvantages of PDT can only be used where light can be reached, and can’t be used on cancer that has spread to multiple places (3). Researchers hope to improve PDT, expand it to other cancers such as brain and prostate, and develop more powerful photosynthesizers.

REFERENCES