Photodynamic Therapy (PDT) and Cancer

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Photodynamic therapy (PDT) is a medical treatment approved by the FDA for more than 20 years. It's a way to treat certain illnesses, such as cancer, in a less invasive manner.

PDT involves two main steps. This therapy uses a special substance called a photosensitizer, which is sensitive to light. First, this substance is given to the patient and allowed to move through the body and gather in the tissues. Then, the area needing treatment is exposed to light of a specific wavelength using a special device. This light causes the photosensitizer to react. Because oxygen is present in the tissues, it becomes excited and triggers a series of events: 1) causing cancer cells to die directly, 2) damaging tiny blood vessels near the tumor, and 3) starting a local response that leads to inflammation. These events target the cancer cells, making them die.

Doctors have researched PDT and found that it can cure some cancers, especially when the cancer is found and treated early. For patients who can't have surgery for their cancers, PDT can help them live longer and have a better quality of life.

PDT can be used before or after chemotherapy, radiotherapy, or surgery without affecting these treatments negatively. Also, the approved substances used in PDT do not gather in the cells' nuclei, reducing the risk of DNA damage that could lead to cancer or resistance to treatment. Additionally, the side effects of chemotherapy or radiation are not present. Resistance to radiotherapy or chemotherapy does not affect how well PDT works.

One of the benefits of PDT is that it doesn't harm healthy tissues much and doesn't strongly affect the whole body. It also doesn't cause significant changes in tissue temperature, which helps preserve the structure of organs undergoing PDT. This means it causes fewer long-term issues. Moreover, cancers usually don't become resistant to this treatment. Another advantage is that PDT often helps organs continue working well and doesn't change a person's appearance after treatment.

Some Current uses of PDT

Breast Cancer[1]

This poster summarizes the use of photodynamic therapy along with a metabolic dietary approach to address a breast tumor in a 79-year-old women with a complex medical history that precluded surgery.

Please click here to view the poster details: https://mtih.org/wp-content/uploads/2023/09/Website-SIO-Poster-20-x-11.5-BRCA-and-PDT.pdf

Cervical intraepithelial lesions and neoplasia HPV[2]

The clinical option for women with high grade HPV infections of the cervix is usually surgical removal of the cervix which may have negative impacts on fertility. The aim of this study was to assess the efficacy of photodynamic therapy with the photosensitizer 5-ALA as a treatment method for patients who had biopsy-proven high grade squamous intraepithelial lesions (HSIL) with high-risk HPV infection. Photodynamic therapy is targeted, impacting only the infected tissue and it is also non-invasive treatment.

A group of 96 women with confirmed high risk HPV infections were treated with photodynamic therapy 6 times over a two-week period. They were reassessed at 3, 6 and 12months. At 3months the total lesion regression rate for the group was 89.6% (86/96) and the HPV clearance rate was 79.17 %. At the 6- and 12-month follow-up, those patients that had experienced lesion regression and HPV negative at 3 months maintained their recovery. Since not all women treated experience resolution, additional work is necessary to establish the characteristics of the cervical lesions where maximum benefits could be achieved. The study authors concluded that PDT can be a safe and

effective treatment for cervical HSIL for those women who desire to preserve their fertility and further investigations are required.

Cervical Intraepithelial Neoplasia[3]
A second study investigated the use of photodynamic therapy or cryotherapy in women with cervical intraepithelial neoplasia 2 (CIN 2). The women in the study selected their desired treatment. Eighty-seven (87) women underwent PDT treatment, and 97 women received cryotherapy treatment. The cryotherapy treatment was performed once while the women who decided to be treated with PDT received three treatments in a one-week period.

The outcome assessed was the clinical efficacy of PDT and cryotherapy in the treatment of CIN 2; demonstrating the resolution CIN 2 was 91.7% for those who underwent PDT, which was significantly higher than that of cryotherapy (81.4%). However, there was no significant difference in the human papilloma virus (HPV) clearance rate between the PDT group and the cryotherapy group. However, the frequency of side effects was significantly lower in the PDT group compared to that of cryotherapy group and there were no serious complications in either group.

Actinic Keritosis[4]
Actinic keratosis is a skin disease that is caused by chronic sun damage, and it is considered an early form of squamous cell carcinoma (SCC) which needs to be treated. PDT is one of the many treatment options available to address these lesions. In some cases, daylight photodynamic therapy is used.

Esophageal cancer[5]
Surgery, chemotherapy and radiation are all components of the treatment of esophageal cancer; however, not all esophageal cancers are amenable to these treatments. Palliative care patients or those with esophageal obstruction may benefit from photodynamic therapy; however, PDT is not an efficient treatment method for patients with lymph nodes or distant metastases.

Inoperable Esophageal Cancer[6]
In this study, 258 patients, whose esophageal cancer was deemed inoperable, were evaluated for a series of sequential treatments which included photodynamic therapy. One hundred and seventy-one (171) patients were treated with photodynamic therapy (PDT), 118 of for whom PDT was their first treatment modality. If PDT was used first, median survival was found to be 50.9 months compared to 17.3 months if any other treatment options were used initially. The authors commented that the use of PDT provided quick relief of dysphagia (difficulty swallowing) and the statistical analysis in this study found that PDT was a safe and effective means to increase the esophageal diameter and reduce difficulty swallowing which also permitted the administration of additional palliative treatments.

PDT Therapy in Barret's Esophagus[7]
A different study assessed the effects of photodynamic therapy (PDT) in individuals with Barrett's esophagus with high grade dysplasia (HGD) in Group A and superficial cancer in Group B. Barrett's esophagus is a premalignant disease that can lead to esophageal cancer. In Group A, 97% and in Group B, 100% achieved complete remission. The mean follow-up was 37 months. Ten patients in Group B and 1 in Group A had a local recurrence and the estimated 5-year survival was 97% and 80% in Groups A and B, respectively.

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