The Christie

High frequency ultrasound – Use in the

Photo Dynamic Therapy Clinic

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Introduction

PDT (Photodynamic Therapy) has been shown to be an effective treatment having high clearance rates and excellent cosmetic outcomes in low risk Basal Cell Carcinomas (BCCs). For PDT to be successful the depth of the tumour should ideally be less than approximately 3mm – to ensure both sufficient penetration of the photosensitizing drug, and penetration of the activating light. High frequency ultrasound (HFUS) at 35MHz has been used extensively within the PDT clinic to determine the extent of such tumours. BCCs can be defined on such scans due to different echogenicity to the normal surrounding tissue. Depth measurements of BCCs to be determined are an important factor as it will feed through to clinical decisions as to whether PDT is a suitable mode of treatment or other treatment options are more suitable.

Basal Cell Carcinomas

A type of skin cancer which develops in the basal cells. Damage to the cells DNA causes it to multiply rapidly, the as accumulation of abnormal cells leading to the formation of the BCC.

- Most common type of skin cancer Non-melanoma skin cancer (> 80%)
- Risk factors include UV damage from the sun or tanning beds or a genetic predisposition (eg Gorlins syndrome)

How PDT works in the treatment of skin cancer

PDT or photodynamic therapy is a means of treating cancerous tumours using a photosensitising drug to selectively destroy cancer cells. The photosensitiser is preferentially absorbed by the cancerous cells. This photosensitiser is then excited by light which causes the generation of a highly reactive singlet oxygen which in turn leads to cell death.

- Photosensitising cream applied over the BCC
- Cream left for 3 hours to be absorbed
- Activated by light (typically red light) activates the drug to destroy the cancer cells
- Can only effectively treat tumours of 3mm or less due to the penetration of light



Singlet oxygen production and other Reactive Oxygen Species leading to cell death

Advantages of PDT

- Uses non-ionising radiation can be repeated
- Non-invasive
- Excellent cosmetic outcomes
- Good clearance rates
- Easily treat large or numerous lesions

The Role of Ultrasound

What is High Frequency Ultrasound?

Generally HFUS is considered to be ultrasound waves of a frequency of greater than 10MHz. The higher frequencies enable a better spatial resolution of the scan to be obtained but with the trade-off of sacrificing the depth over which the scan can provide useful information due to the increased attenuation by the tissue. For skin tumours seen at the PDT clinic this is not normally an issue as imaging information is only required for the depth of the dermis which typically ranges from 0.7 to 4.5mm.



BCC and corresponding ultrasound scan

As part of the treatment pathway, patients attending the clinic are first given an ultrasound scan on the tumours and any other suspected tumours

HFUS scans have been undertaken in multiple sites (up to 11) on 213 patients in the last year. The majority (184) were treated for Basal Cell Carcinomas, 18 for Bowen's disease and 11 for Actinic keratosis.





BEFORE Treatment

Treatment

HFUS used to monitor treatment effectiveness Summary

HFUS scans have proven to be extremely useful and are regularly performed on patients in the PDT clinic. Not only for determining whether PDT is the optimal technique for treatment the BCC but also in the monitoring of the effectiveness of the treatment, detecting any subclinical residual disease and additionally to monitor tumour shrinkage should repeat treatments be required. Its use in further applications in skin oncology in the Christie clinic is also being explored.

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