Study of Spatial Variation of Intensity of Light Induced Fluorescence for Cancer Diagnosis

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Abstract—Several methods like biopsy, synchronous luminescence, HPGLC High precision gas liquid Chromatography, Raman spectroscopy; have been employed in the diagnosis of cancer. The laser induced fluorescence method is one of the useful and fast techniques of the cancer diagnosis. The intensity of the laser induced fluorescence increases as the malignancy increases. It may be used widely as it is portable, non invasive and quick method of diagnosis.

Keywords—Laser, Fluorescence, cancer, biopsy

I. INTRODUCTION

It is very difficult to diagnose the cancer in first stage when it can be cured. And when it is diagnosed it is in the third stage when it is very difficult to cure. Also when it is diagnosed, the degree of malignancy is not accurately known which becomes very difficult for the treatment. Therefore methods should be investigated for the diagnosis of cancer in the first stage and also for accurate determination of the degree of malignancy, so that proper treatment can be given and it can be cured. Optical spectroscopy has been widely used to acquire fundamental knowledge about physical, chemical and biological processes that occur in biomaterials. In particular, laser induced auto-fluorescence, which was first observed by Stokes and later was recognized as a potential diagnostic tool by Stuble, has been extensively studied over the past 20 years and significantly emerged as a promising technology for biomedical diagnostics. The method is based on differences in auto-fluorescence of cancerous and non cancerous tissues. Since any change in the concentrations, quantum efficiency or in the binding sites and the environment of the fluorophores gets reflected in their fluorescence properties giving rise to a contrast in fluorescence between the normal and the cancerous tissue sites. It was reported that fluorescence intensity was significantly lower in healthy tissue than pathologically confirmed cancerous tissue. Significantly higher intensity and more fluorescence hot spots occurred in dysplasia and carcinoma than in healthy tissue hyperkeratosis, mild and moderate dysplasia.

A. Experimental Set Up:

The experimental set up consist of a nitrogen laser as a source of light, a spectrometer as a spectrum analyzer, CCD camera as a detector & optical fiber for carrying the light for different places. A special arrangement is done for the sample holder so that the sample can be moved across the field of view & spatial distribution of light scattered may be investigated. The experimental arrangement is as shown in the following figure.

B. Result and Discussion

We record the intensity of the fluorescence emitted from the sample cut from the sample cut from the breast. The sample was shifted towards right side by 1mm every time & the fluorescence spectra was recorded for the sample at four different places. A tissue was cut from the normal position of the breast which was pathologically proved to be normal & then its fluorescence spectrum was recorded. All the spectra is displayed in figure (A). It is observed that the intensity of fluorescence is increased in cancer tissue as compared to normal breast cells which is characteristic of cancer. The given sample exhibit 2 peaks at 340nm and 475 nm which can be attributed to tryptophan and NAD(P)H respectively. The intensity ratios of cancerous to normal (C/N)is plotted against wavelength and displayed in fig.(B). The intensity ratio is maximum at 318.75nm , it is 6.7.
II. CONCLUSION

The LIF technique clearly shows the difference between the fluorescence spectra emitted by normal and the corresponding cancerous cells. It is clear that the intensity of spectra emitted by fluorophores tryptophan and NAD(P)H in cancerous cells is more. The variation in the intensity ratio might help in the determination of degree of malignancy. Thus it may be concluded that the LIF spectroscopy is very good technique for detection and diagnosis of breast cancer.

C. Figures and Tables

TABLE 1 - TABLE TYPE STYLES

Figure (A): Intensity of light induced fluorescence as a function of wavelength

Figure (B): Ratio of the intensity of light induced fluorescence emitted by cancer tissue to normal tissue.

REFERENCES


