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DETECTING TUMORS IN HUMAN BODY BY THE MEANS OF LIGHT

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Abstract

Magnetic Resonance Imaging(MRI) has become one of the greatest inventions used to find even the smallest cancer particle in a living creature. But is it really safe? Aren't there any risk factors involved in the usage of x-rays or gamma rays? Here we have gathered information about the usage of just light from our visible spectrum to not only detect the cancer particles, but also the behaviour and activities of these particles. Light is all around us, and we don't use it to its maximum potential. Why go for artificially produced light for treatments and other purposes when you can use the natural source of light. It has been recently found that light which falls in the visible region of the electromagnetic spectrum can be used to see deep inside body and brain and conclude with suitable treatments. A recent advancement in the study of biomedical and technological advancement shows that there are various means by which tumors and other harmful molecules can be detected and diaphanography is becoming a major part to study upon under this particular area.

Keywords: *infrared light, diaphanography, tumors, holography, oncology*

Introduction

Healthcare, the most sought-after sector of the modern world, is witnessing new heights when it comes to technological advancements. The use of magnets and electricity was the beginning of this developing era when it started to shift away from the simple technique of guessing via symptom analysis. Each and every time, our brain makes us believe that this is the best development that is possible in this sector, however the very same brain, forces us into asking the questions of how and why. Thus, when healthcare was peaking with the use of electromagnetic instruments, Science, on its own led us into another astonishing discovery which was intelligently put together for yet another invention in this concerning sector. We come to realise that light pierces through our flesh and comes out of the surrogate direction, following the very same path as through which it enters. This light then passes through human cells help in discovering tumors and blood clots all through our body. Now, the only shortcoming of this technique is that light, when passing through this medium, scatters, as is it's property. Thus, we use a hologram to 'de-scatter' the scattering rays of light. This solves most of the problem that is faced while using this technique. There is a high-tech miniature imaging device, which can image the most sensitive organ of the human body, that is the brain, without causing any damage, since it uses infrared light or simply red light or green light. This is so small, it consists of only 3 discs which use sound waves and light waves simultaneously to detect tumors inside our brain and other body parts. This technique is more efficient, cost wise and space wise, and thus can be made easily available to remote areas, in ambulances and emergency rooms of the smallest of hospitals as well, so as to save the time after a stroke to detect it's type and provide the right treatment to the victim. This miniature computerized imaging device is so compatible that it doesn't require any kind of surgery or alternative brain surgeries either, it can simply be worn around one's waist as a bandage or on one's head, as infrared light has no problems in crossing the skull. Moreover, usage of red or infrared light doesn't cause harm like that of gamma rays or x-rays,

as when they penetrate through our body, sometimes cause tumours. So, this is by far the most intriguing of all the recent inventions and can be the most effective of all as well if studied and promoted properly. Especially, in a country like India, where medical facilities are not present in most of the remote areas and are unavailable to almost 65 percent of the population, this device can act as a messiah and save a lot of lives.

Literary Survey

[1] Diaphanography a technique which uses near-infrared light to image inside the tissues and that helps us see the internal structure and thereby helping characterise tumours easily. Photon migration is nowadays used in analysing the scattering images on an ultrafast timescale. Light propagation in human tissues gets difficult after every small movement deeper inside. For this reason, light undergoes multiple scattering from a collimated beam and propagates through various layers of tissues. Another method is known as the temporal resolution method which has helped in imaging structures of various tissues, predicting drug levels used for various treatments. This method has also been used to identify solid tumours which are embedded deep inside beneath the tissues by using short light pulse and reading the phase and frequency of the output pulse obtained. These methods, which help in measuring malignancy, and other factors like age and menopausal status can determine primarily the presence of breast cancer.

[2] Light of the visible region is used in imaging of tissues and tumors. But it mentions that the use of NIR is better compared to red light as haemoglobin and blood have smallest adsorption coefficient of this region of light which prevents any further complications as in gamma rays or x-rays. Nowadays, it is used in collaboration with MRI to get the desired result. The focus is also given to the detection of early cancer and symptoms using receptor -targeted probes, to get the effect reduced. Fluorescent proteins are also used which are similar to CT but uses a framework to analyse the diffused nature of light photons in tissues. Bioluminescence imaging technology uses light emitted during enzyme catalysed reactions to detect flaws in molecular level and in small animals. This analyses each part of the animal and gives partial holographic imaging of the defects present in the body and guides us to proceed to further actions to be taken. It also says that proceedings in this field are going to bring about drastic changes and also help reduce the minimum of the absorption and scattering of light that will happen with advancement in this technological world.

[3] The world of biochemical imaging got a new development with the Introduction of invasive mapping that use fluorescence to map molecular events in intact tissues. The silver lining of this new technology is that the base of this technology is strengthened by the detection and discovery of probes which are not only specifically fluorescent but are also amazingly biocompatible and, also new technologies for highly sensitive imaging was developed. The ability of photons to be able to penetrate several centimetres in tissue can be attributed to fluorochromes which cause water and haemoglobin to be absorbed minimally and emit in the near Infrared range.

[4] Visible light inside opaque objects is generally absorbed or scatter the light photons entering it. This difference has led to light probes categorised as spectroscopy and imaging. The utility of either of this approach is based on how well the methods can differentiate the defective tissue and the normal tissue. Spectroscopy is useful in the time to time analysis in the alteration in the absorption and scattering rates. This helps us get them to the right conclusion of what the exact problem is like in monitoring the flow of blood in the various cerebrum lobes-frontal, parietal or occipital and giving results of internal bleeding due to any head injury. The imaging is used to

differentiate it from the background tissue and detect early the cancer globule and curb the problem before it can spread any further. An experiment is performed where a setup is made similar to human tissue and two optical fibres are used to inject infrared photons onto the sample and the other is used to detect the photons at some other location. These read out the various patterns of scattering and absorption and help in locating the exact position of the particle.

[5] The focus is given on the need to detect a tumor in the early stages of its formation. This diagnosis of premature lesions is crucial for decreasing its complexity and increasing the survival rate. Chromoendoscopy and fluorescence endoscopy have been developed to increase the detection of tumors in various parts of the human body, like the lungs and colon. Cyanine dyes have been used to bind to receptors on the tumor affected cells. These are used due to high selectivity and affinity with low doses of input itself. It also talks about the low penetration of near-infraredlight but the dyes help in the detection ofof-of superficial lesions.

[6] Multispectral polarised light imaging(MSPLI) is used for the inspection of skin cancer and also study different skin disorders. Confocal microscopy is the method used for focussing light on the specimen. An image is captured by gathering the behaviour of the light reflected which is collected by the detector of the microscope. The difference in the resolution in the detector tells us the difference in the thickness of the cancer tissues. This method allows imaging in large view, is cost efficient and less time consuming, but doesn't supply information about the primary structure of the cancer cell.

[7] There are many methods of imaging tumors in small animals like planar imaging, fluorescence tomography, bioluminescence tomography and optical detecting. These methods allow three-dimensional imaging which helps us analyse better. Planar imaging is all the more complicated as it doesn't allow resolving of tissues whereas tomography changed this idea and gave way to overcome the same.

[8] Hematoporphyrin derivative(HPD) is found to be used in curing cancer in areas like breast, colon, etc. It is found to be curative for a number oftumors. The experiment is carried out by using the dye followed by the focusing of red light on the spot of the tumor. Results have shown that complete response towards tumors was found within a span of 24 hours.

[9] In vivo imaging -in association with the near-infrared light has been used under the detection technologies in the new ways of biological approach.There is a comparison being made with different methods which are primarily based on resolution, depth of penetration, the detection of threshold probes and expandability of the image. In vivo is being used in collaboration with other methods to increase the accuracy in the end results.

[10] Approaches of molecular imaging to detect and phenotype tumors has made it which allows it to study deep inside the tissues and also observe the structural differences in the affected tissues. Fluorescence imaging allows us to observe the fluorescence change in the animals but limits to the fact that it only allows resolving of fluorescent molecules. This uses a methodology that it injects red light to the specimen and the reflected light is got by the detector in the form of green light with precision and accuracy in the structure as well as the location of the tumor.

Findings

The research gives us a clear idea on how there are many ways in which tumors and other hazardous particles can be detected using the means of light which falls in or near the visible region of the electromagnetic spectrum. This helps us

Conclusion

Detection of tumors using light was thought to be a really small topic which was not so when we completed the paper. The technological advancement in this field is unexceptionally vast and the study is still proceeding further, where faster and better results will be processed in near future and hope to see the technology reach every part of the world and make the smallest difference in each one of their lives.

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