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EDITORIAL

Imaging as a diagnostic and therapeutic tool in clinical oncology

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Abstract

According to the WHO report published in 2010, about 13% of all deaths are due to cancer. Of these, lung, liver, stomach, colon and breast cancer are the most prevalent. It was also reported that about 30% of the deaths due to cancer can be avoided, if diagnosed and treated early. Hence, there is an urgent need to diagnose these cancers efficiently. Various imaging and therapeutic methods have been proposed and used to accurately detect cancer. In this special two issues, there are eight papers covering different aspects of oncology using various imaging or therapeutic methods.

Key words: Imaging; Clinical oncology

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Medical imaging and diagnostics have been established techniques over the last 50 years. Various endoscopic models have been designed and developed which differ in their ability to inspect the inner surfaces of the body cavities. Furthermore, the rigid nature of such endoscopes and the need for high resolution imaging has enabled researchers to develop more sophisticated flexible probes for medical and single cell imaging for early disease diagnosis. In this special two issues, there are eight papers covering different aspects of oncology using various imaging or therapeutic methods.

Paper 1[1] introduces the background of optical spectroscopy in cancer management, which includes the advantages of this technique compared with other established techniques, the principle of optical spectroscopy and the typical instrumentation setup. Current progress in optical spectroscopy for the diagnosis of cancer in the brain, breast, cervix, lung, stomach, colon, prostate and skin are reviewed. A few commercially available clinical instruments based on optical spectroscopy techniques are presented. Several technical challenges and standard issues are also discussed.

A preliminary system to perform online rendering side-by-side with laser scanning confocal endomicroscopic imaging is presented in Paper 2[2]. By having an immediate knowledge of the dataset quality as well as the biological tissue conditions, alterations can be made on the spot. This will introduce the opportunity to change imaging conditions or medical decisions according to the online rendering results. This work is also motivated by the need to realize the quality of the captured datasets in real time to reduce excessive time required for offline rendering.

Imaging of gastroenteropancreatic neuroendocrine tumors can be broadly divided into anatomic and functional techniques. Anatomic imaging determines the local extent of the primary lesion, providing crucial information required for surgical planning. Functional imaging not only determines the extent of metastatic disease spread, but also provides important information with regards to the biologic behavior of the tumor, allowing clinicians to decide on the most appropriate forms of treatment. Paper

3[3] reviews the current literature on this subject, with an emphasis on the strengths of each imaging modality.

Existing imaging modalities for breast cancer screening, diagnosis and therapy monitoring, namely X-ray mammography and magnetic resonance imaging (MRI), have been proven to have limitations. Diffuse optical imaging, a set of non-invasive imaging modalities using near-infrared light, may be an alternative, if not a replacement, to those existing modalities. Paper 4[4] covers the background knowledge, recent clinical trial outcome, and the future outlook of this newly emerging medical imaging modality.

Paper 5[5] presents a technique for automation in the diagnosis of breast cancer from immunohistochemically stained biopsy specimens. It has been demonstrated through this work that manual evaluation introduces a number of variations, whereas automated analysis provides objective evaluation and is repeatable. Such automation can facilitate fast and efficient diagnosis of breast cancer cases and eliminate human errors to a large extent.

Efforts have been made to improve the accuracy of breast cancer diagnosis using different imaging modalities. Ultrasound and MRI have been used to detect breast cancers in high risk patients. Recently, electrical impedance imaging and nuclear medicine techniques are also being widely used for breast cancer screening and diagnosis. Paper 6[6] discusses the capabilities of various breast imaging modalities.

Paper 7[7] proposes techniques to investigate the strength of support vector regression in cancer prognosis using imaging features. In this work, the authors have used the combinational methods of Support Vector Classification-Regression, feature selection, and sampling that can improve cancer prognosis. More significant features may further enhance cancer prognosis accuracy.

The clinical outcomes of high intensity focused ultrasound (HIFU) ablation applied to cancers are discussed. The current challenges in the application of HIFU in tumor treatment, such as HIFU-mediated drug delivery, vessel occlusion, and soft tissue erosion ("histotripsy") are discussed in paper 8[8].

We hope that the papers in this special issue will help to disseminate knowledge in the field of clinical oncology.

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