A RF transmit/receive coil system for C-13 and H-1 magnetic resonance spectroscopy and imaging of human breast at high field (7T and 3T)

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Technology description

Background

Great strides have been made in the imaging and diagnosis of breast cancer but the NCI reports the following flaws with each diagnostic method: 1) Mammography exposes patients to radiation, has a high false positive rate (70%) and cannot capture a tumor's physiology. 2) Sonography can only guide a physician during biopsy or determine if a mass is fluid filled or solid. 3) MRI cannot distinguish benign breast disease from malignant cancers. 4) PET utilizes radioactive agents, can not easily detect small, non-aggressive masses, and is dependant on a single marker. A new method is needed to address these flaws.

Technology

Magnetic Resonance Imaging (MRI) in combination with Magnetic Resonance Spectroscopic Imaging (MRSI) is a promising method for breast cancer diagnosis without the limitations of current methods. This technology provides both an anatomic picture of the breast and biochemical and physiologic information. The MRI/MRSI combination may identify key biochemical changes before the tumor becomes detectable by other imaging methods such as PET that rely upon single markers not entirely sensitive or specific for malignant activity. MRI/MRSI is potentially well suited for screening and repeated monitoring as it entails no radiation exposure. The invention is a combined volume H-1 coil (standard proton coil) and butterfly C-13 coil (carbon proton coil) as a unified breast coil system for the simultaneous detection of both H-1 and C-13 signals from human breast tissue. The combination of these two coils permits imaging of chemicals elevated specifically in breast cancer which improves breast cancer diagnostic specificity.

Application area

1) Breast cancer detection
2) Breast cancer treatment efficacy
3) Clinical diagnosis and study of other breast diseases

Advantages

1) The MRI/MRSI provides both an image of the breast and information about the biochemical activity of the tissue. This has two important implications: a) Sensitive and accurate diagnosis of breast disease b) Monitors the efficacy of a treatment regiment by viewing the biochemical activity of a tumor.
2) Coil can be modified to detect other nuclei such as Na-23 and F-19 allowing for detection of different biochemicals.
3) Procedure does not expose patients to radiation.

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