Can MRI Be Used as a Novel Technique to Diagnose Human Bacterial Blood Infections?

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The purpose of this project was to evaluate whether the FS-T1 and FS-T2 MRI sequences can consistently detect and differentiate Gram-positive and Gram-negative bacterial species in human blood from subjects of different ages and genders and at different concentrations. This student hypothesized that the Gram-positive and Gram-negative bacterial species could be differentiated due to the structural and chemical differences in their cell walls. This student designed and conducted 3 experiments for this project. In experiment 1, it was tested whether the FS-T1 and FS-T2 MRI sequences could differentiate between Gram-positive and Gram-negative bacterial species in human blood. In experiment 2, it was tested whether the MRI sequences could differentiate between Gram-positive and Gram-negative bacterial species in blood from subjects of different ages and genders. In experiment 3, it was tested whether the MRI sequences could differentiate between Gram-positive and Gram-negative bacterial species in blood at lower concentrations. The bacteria were scanned using a Siemens MAGNETOM Symphony 1.5 Tesla MRI machine with the FS-T1 and FS-T2 MRI pulse sequences. The MRI signal intensity values were measured using a DR PACS computer. A total of 1,100 measurements were taken and entered into a Microsoft Excel spreadsheet to be analyzed. The results of this project showed that the FS-T1 and FS-T2 MRI sequences can consistently differentiate Gram-positive and Gram-negative bacterial species in human blood. In conclusion, this project was the first attempt of using MRI for rapid and accurate bacterial identification in human blood. The findings could potentially generate a major impact on diagnosing human bacterial blood infections and combating antibiotic resistance.