Objectives: To Utilize Routine MRI Brain examination to establish findings of Cortical Atrophy in NFL Players with concussion as well as the Clinical Concussion Syndrome and to establish a point of reference to monitor players for follow up MRI Examinations

Variables: First to establish the degree of normalcy of the brain anatomy when players enter the NFL given that players may have had a varied number of concussions during their college career and possible as early as high school sports. My team includes noted Neurologists as well a Pediatric Neuroradiologist as part of the team in which we will establish a parallel evaluation for the pediatric and adolescent community.

Hypothesis: Our hypothesis is that mTBI/Concussion causes known microscopic neuroaxonal damage which leads to neurodegenerative pathological with the magnification of the Ionic cascade system for brain inflammation and atrophy. The utility of routine Magnetic Resonance Imaging (MRI) will establish and diagnose early Cortical Atrophy in National Football Players (NFL) and to hopefully utilize this finding of atrophy as a point of reference for follow up imaging during their career or as a neuroimaging marker to establish and diagnose early changes of CTE.

Methodology:

Multicenter Study at Rush Medical Center, Chicago , The University of Illinois Medical center and University of Virginia Commonwealth medical Center are the sites of the study. Each study center will recruit 50 Professional Football Players from the NFL with 50 aged matched control subjects with IRB certification for inclusion.

The age range for inclusion into the study consists of an age range of 24-40 years with an average age of 30 years. For the brain MRI studies NFL Players with less than 3 known established concussions documented by Player Personnel in their college football career. Exclusion criteria to the study are players with known illegal substance or alcohol abuse as well as other major neurological diagnoses ,medical systemic illnesses such as Lupus Eryrmatosus and our history of seizure disorder.

MRI Imaging consists of Internationally accepted MRI Brain Protocol established by the major manufacturers e.g Siemens, General Electric, Philips, Toshiba etc. Scan parameters include the utilization of Routine Scout images as well as Fluid Attenuated Inversion Recovery(FLAIR) axial

Series of images , Routine Coronal T2-weighted images as well as Sagittal T1-weighted images. Manufacturer measuring tools for the measurement of the area of demonstrated cortical sulci.

Control aged matched subjects are included if no history of illegal drug or alcohol abuse, No known neurological or systemic medical conditions and no contraindications for specific facility MRI Intake sheet especially including a history of a Pacemaker, Defibrillation device, TENS unit or history of orbital infiltration with metallic fragments from employment. Discontinuation from the study cohort is paramount if during the study period, a subject is diagnosed with a systemic or neurological Medical condition.

The Central Sulcus is an important anatomical landmark of the brain as it divides the brain connectivity inputs and output motor and sensory. Several studies utilizing the Central Sulcus on CT examinations have been attempted. Over the years it has been proven that MRI is far superior to CT imaging due to its higher spatial resolution to delineate different makeup of the brain parenchyma as well as the cortex. Our preliminary study with servicemen demonstrated that the degree of atrophy can be established congruent to the increase in the area of the Central Sulcus. The degree of CS was established in our preliminary study on servicemen and measured area of CS (millimeter -squared) in a wide age range of patients (17-90 years) were obtained to establish the Normal size of the Central Sulcus but also to establish and demonstrate Mild, Moderate and Severe cortical atrophy which parallel increase area of the CS on MRI Imaging in our preliminary study.

Measurement of the Area Central Sulcus (CS) will be performed using routine freehand measuring tools from Commercial PACS systems. The area of the CS will be measured using Axial FLAIR images which is the best imaging sequence to delineate the gray matter strip from the Cerebrospinal Fluid (CSF) as performed in our preliminary study with veterans. The normal area of the CS is established in our preliminary work and the degree of Cortical Atrophy which is congruent with the area of the CS is similar to our work with the servicemen from Middle East Conflicts with similar age range as well as an average age of 31-years.