Project Goal: The goal of this research project is to deepen our understanding of brain injuries in newborn babies. Unlike adults, detecting brain injuries in babies is tough due to their smaller heads, which means lower-resolution MRI images. Also, there's no one-size-fits-all sign of a baby born with brain injury. Sometimes, injuries occur earlier, during pregnancy, or due to genetic factors. By combining MRI scans with clinical data and using advanced computer analysis, this study aims to create new tools to predict and manage neonatal encephalopathy and encephalopathy of prematurity.

Research Description: Specifically, we use Magnetic Resonance Imaging (MRI) to improve how we diagnose and predict outcomes for newborns. MRI is a really important tool, because it gives us the most information about what's going on in a newborn's head. Specifically, MRI looks at differences between water and fat to create high resolution images of brain structure. We look at two groups of patients and their data: a retrospective group (Cohort A) and another group we recruit in this study (Cohort B). Next we use computer programs to measure brain injuries on MRI scans and see how these injuries match up with the patient's clinical data. What we discover at this step informs how we build a new imaging scale for better definition of injury.

Reason for Tackling this Particular Problem: Neonatal encephalopathy and encephalopathy of prematurity are really risky for newborns—they can cause lasting brain damage or death. Right now, the tools doctors use to predict and manage these conditions are not perfect; however, MRI technology is only getting better, both in terms of image resolution and the diversity of information we can map in someone's brain. Combining advanced MRI techniques with computer analysis gives our work the chance to make things better and give doctors more precise tools for diagnosing, understanding, and treating these problems. We also want to improve how we interpret MRI scans and find better image clues for these problems.

Expected Results: This study should give us some big results. First, we want to check if computer scoring for MRI brain injuries is trustworthy, so we compare to hand-scored images. Second, we want to see how MRI scans match up with what the doctor sees in the clinic, and if we can improve this relationship. Third, we are working on a new way to score MRI brain injuries (NeS) that could change how easily, quickly, and confidently doctors check for these problems. Lastly, by looking at MRI scans with tests of proteins and chemicals in urine, we think we can find out more about how these brain problems happen and what we can do about them.

In summary, this research project aims to advance the field of neonatal neuroimaging, offering new tools and insights that could significantly improve the diagnosis, management, and outcomes of newborns with brain injuries, ultimately benefiting the lives and well-being of future generations worldwide.