

Applications of Magnetic Resonance Imaging for Prognosis of Fetal Neuropathology

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Target Audience: Clinicians

Introduction: The World Health Organization defines perinatal mortality as the “number of stillbirths and deaths in the first week of life per 1,000 live births, after 24 weeks gestation”. There are 5.9 million perinatal deaths worldwide, almost all of which occur in developing countries. The fetal mortality rate in India is amongst the highest in the world. The working mechanism of the brain in fetus poses a great challenge to understand the fundamental process that underlies the cognitive development [1] [2]. Current work involves description of case studies in fetus demonstrating the utility of fetal MRI.

Purpose: Recognition of central nervous system (CNS) abnormalities through prenatal imaging has awakened interest in fetal neuropathology. The current work has been performed to aid clinical decision-making regarding a wide range of neuro-developmental disorders such as: Occipital Encephalocele (0-85/1000 cases) [3][4][5], Occipital Meningocele (0-28/1000 cases) [4], Sacral Meningocele, Lumbar Meningocele. Diagnosis can aid parents and doctors make decisions during pregnancy and perform corrective action if required through surgery. They can also prepare in advance for the challenges that the child and family may face. Quantification of changes of brain structures as well as changes in the microstructure of white matter could be performed.

Methods: We have acquired 80 control and pathological datasets (T2 weighted, single shot Fast Spin Echo (ssFSE) images with TR=1750, TE=91.6, slice gap of 5) of fetus in 28-32 weeks of

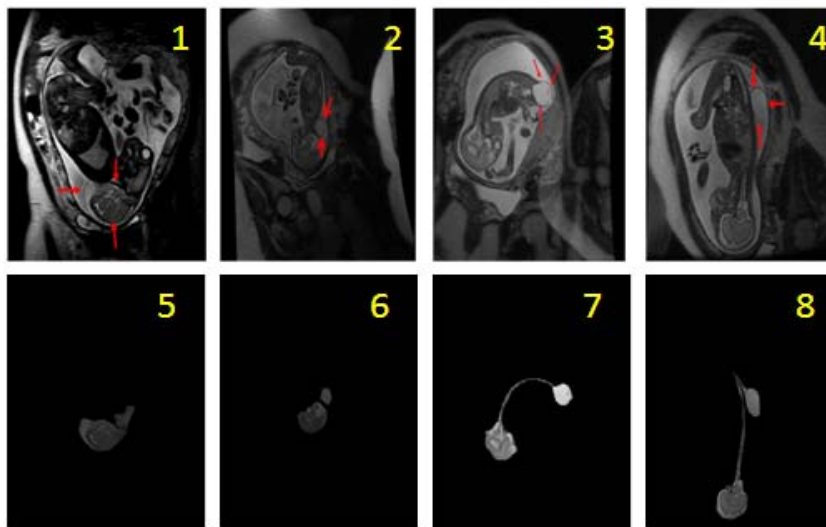


Fig 1: Occipital Encephalocele , Fig 2: Occipital Meningocele, Fig 3: Sacral Meningocele, Fig 4: Lumbar Meningocele and Fig 5,6,7&8 are its respective segmented images.

The nerves remain protected and therefore are not as badly damaged. So the doctors can wait and then do the surgery after delivery depending on the size of the tumor. In Encephalocele as the brain is outside the cranium depending on the size of protrusion doctors can decide whether to perform fetal surgery or terminate the pregnancy.

Conclusion/Future Work: The current work will play an important role in determination of the fetal brain pathologies non invasively in early stages itself for high risk pregnancies and terminating the pregnancy if required. It helps in understanding of developmental biology and the functional connectivity of the fetal brain and the psychology of growing fetus. We have segmented brain and spinal cord of the fetal pathologic datasets which will further help us in generating a template for learning algorithms to find out the abnormalities existing in future fetal datasets which will also help the radiologist to determine the severity of diseases automatically. After building the discriminator we shall map the discriminator to build predictors for fetal neuropathology. The mother can take precaution if pathology is determined at an early stage of gestation in high risk pregnancies.

References:

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