

## **A novel 3D/4D ultrasound-based combined structural and functional score for prenatal sonographic assessment of fetuses with CNS anomalies and its correlation with early postnatal neurological outcome**

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### **Objective**

To propose a novel scoring system using 2D and 3D/4D ultrasound parameters, involving both structural aspects of the anomaly and foetal behaviour. To assess the correlation of this score with postnatal survival and neurodevelopment.

### **Methods**

This is a prospective cohort study conducted in the Department of OBG, JIPMER, a tertiary care institute in India between 2019 and 2021. Consenting adult antenatal women with structural CNS anomalies in singleton fetus diagnosed or presenting at or after 20 weeks of gestation were included. A detailed neurosonogram incorporating 3D/4D evaluation to assign the score, considering both structural components of the anomaly and foetal behavioural aspects after a minimum of 30 minutes of assessment was done. This score was then correlated to postnatal outcome by noting neurodevelopmental assessment, performed at birth with APGAR scores and by standard Hammersmith Infant Neurological Examination (HINE) score on survivors at 3months.

### **Results**

Prenatal Combined Structural and Functional assessment of fetuses with CNS anomalies correlated strongly with postnatal outcomes like Apgar at 1 and 5 minutes( $r=0.76$ ), whether or not the baby survived at 6 months( $r=0.86$ ), days of survival ( $0.75$ ) and had strong statistically significant association with postnatal HINE scores predictive of cerebral palsy( $p=0.000$ ) and severe non-ambulatory CP( $p=0.000$ ). A cut-off score of 13 was derived, which demarcated statistically significant differences in postnatal outcomes. Structural Score alone also correlated strongly with postnatal outcomes like Apgar scores( $r=0.735$ ), survival( $r=0.817$ ) at 6 months and HINE scores( $r=0.730$ ) at 3 months corrected age. Above and below a cut-off score of -3, there were statistically significant differences in postnatal outcomes. The functional score did not correlate strongly with HINE score( $r=0.285$ ) at 3 months or survival at 6 months( $r=0.464$ ) or Apgar scores ( $r=0.48$ ). Statistically significant difference in outcomes was found only at a high cut-off score of 17 out of 18.

### **Conclusion**

Through our study we have proposed a new ultrasound based scoring system, involving both structural and functional aspects, for foetal CNS anomalies. This score correlated strongly with postnatal neurological outcomes which could guide clinicians in prognostication and counselling the pregnant women with fetal CNS anomalies. There are few studies on scoring by correlating foetal behaviour and outcome but this is the first study to incorporate a combined structural and functional assessment to prognosticate outcome in fetal CNS anomalies.