Understanding Neurodevelopmental Outcomes in Pregnancies Impacted by Congenital Central Nervous System Anomalies

Jack Menard, BS[1], Tabitha Quebedeaux, MD/PhD[2]

Louisiana State University Health Sciences Center- School of Medicine[1]; LSUHSC, Department of Obstetrics & Gynecology, Division of Maternal-Fetal Medicine [2]

1a. Introduction

Learning that your baby has a *central nervous system (CNS) anomaly* during pregnancy is among the most distressing experiences a family can face. Despite advances in ultrasound and fetal MRI, accurately **characterizing these anomalies** and **distinguishing them** from insignificant findings remains challenging.[1]

Understanding how *clinical factors* and *location of the anomaly* contribute to these challenges is essential for improving prenatal counseling for fetal CNS anomalies.

1b. Background

Several factors impact characterization of fetal CNS anomalies including:

A. *Region of the Anomaly*[2]

Supratentorial

↑ Structural Variability

Subtle cortical & midline findings difficult to define prenatally

Posterior Fossa

↓ Visibility

Complex anatomy & shadowing from bone obscure detail

Spinal Region

Spine Curvature Obscures View

Spine position → Difficulty assessing open vs. closed neural tube defects

B. *Clinical Factors*[3,4]

- ***Imaging Modality**: MRI improves detail*
- ***Maternal Obesity:** ↓ Ultrasound clarity*
- ***Advanced Maternal Age (AMA):** ↑ Anomaly risk*
- ***Gestational Age (GA):** Development Impacts Visibility*
  → ***Early scans**=incomplete anatomy → **Late scans**=obscured view*

1c. Objectives

Assess the accuracy of prenatal CNS anomaly diagnoses made using fetal neuroimaging techniques

Evaluate how anomaly region, imaging modality, maternal factors, and gestational age influence diagnostic consistency.

2a. Cohort Selection

Study type: Retrospective cohort study

Population: Pregnancies diagnosed with fetal CNS anomalies *between 2019 and 2025* under the care of LSUHSC Maternal-Fetal Medicine (MFM) physicians.

105 cases: *CNS Anomalies Identified*

All pregnancies (**105**) in the LSUHSC–MFM perinatology-neonatology care (PNC) database with a **documented fetal CNS anomaly.**

***Excluding** Non-isolated Anomalies →* **76 cases**

Remaining cases (**76**) do not have **major non-CNS malformations** or multisystem anomalies affecting *other organ systems.*

***Excluding** Insufficient Records & Fetal Demise →* **48 cases**

Remaining cases (**58**) have **sufficient longitudinal records** and cases ending in **live birth**.

***Excluding** Anomalies Resolved Prenatally →* **37 cases**

Final cohort (**37**) characterized by **persistent CNS anomalies at birth** (excluded those with transient or resolved prenatal findings).

Final cohort: *37 pregnancies with isolated, non-resolving fetal CNS anomalies and complete longitudinal records*

2b. Data Collection

For each case, *we collected*:

I. **Prenatal data:** Final prenatal CNS diagnosis, imaging modality, GA

II. **Maternal data**: Body-mass index (BMI) and age

III. **Postnatal data**: **Postnatal outcome**, imaging modality

Postnatal outcome categorized as:

A. Confirmed: prenatal diagnosis matched postnatal diagnosis

B. Redefined: prenatal diagnosis modified postnatally

C. Insignificant: prenatal finding deemed clinically insignificant

Note*: "Reclassified**"="Redefined" + "Insignificant"

2c. Hypothesis

We hypothesize that accuracy of prenatal CNS anomaly diagnosis is influenced by both the **region of the anomaly** and **clinical or imaging-related factors** that alter fetal visibility.

3a. Results

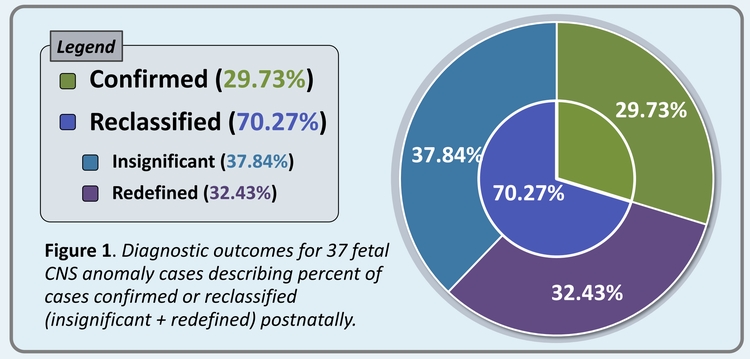

Figure 1. *Diagnostic outcomes for 37 fetal CNS anomaly cases describing percent of cases confirmed or reclassified (insignificant + redefined) postnatally.*

CNS Region (*p=0.32*)

CNS Region	Confirmed (n)	Reclassified (n)	Total (n)	% Reclassified
Supratentorial	9	18	27	67%
Posterior Fossa	2	2	4	50%
Spine	0	1	1	100%
Multiple	0	5	5	100%

Prenatal MRI Use (*p=0.41*)

Prenatal MRI Use	Confirmed (n)	Reclassified (n)	Total (n)	% Reclassified
Yes	7	20	27	74%
No	4	6	10	60%

Maternal Obesity (*p=0.49*)

Maternal Obesity	Confirmed (n)	Reclassified (n)	Total (n)	% Reclassified
Yes	6	11	17	65%
No	5	15	20	75%

AMA (*p=0.11*)

AMA	Confirmed (n)	Reclassified (n)	Total (n)	% Reclassified
Yes	1	9	10	90%
No	10	17	27	63%

GA at Diagnosis (*p=0.36*)

Gestational Age	Confirmed (n)	Reclassified (n)	Total (n)	% Reclassified
<20 weeks	3	2	5	40%
20–24 weeks	2	10	12	83%
25–32 weeks	4	10	14	71%
>32 weeks	2	4	6	67%

Figure 2. Stratification of CNS anomaly cases by region and clinical factors. While minor variations in reclassification were observed among these variables, none reached statistical significance (all p>0.05).

3b. Conclusion

Although no significant associations were found between reclassification and anomaly region, MRI use, obesity, age, or timing of diagnosis, the **consistent high reclassification rate** *highlights the importance of postnatal confirmation in fetal CNS anomaly counseling*.

Recognizing when and why these discrepancies occur may help improve the value of fetal neuroimaging and help clinicians provide more accurate prognoses for families.

3c. Future Steps

A. Expand cohort for greater statistical power.

B. Standardize reclassification terminology.

C. Link prenatal imaging with postnatal **neurodevelopmental outcomes.**

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