

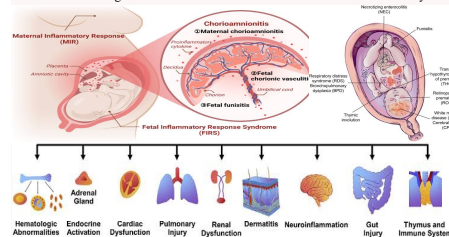
Fetal Renal Doppler Predicting FIRS in Preterm PROM: A Diagnostic Breakthrough

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Introduction

A key consequence of PPROM is the development of fetal inflammatory response syndrome (FIRS), which involves systemic fetal inflammation triggered by microbial invasion of the amniotic cavity. FIRS affects **35-65% of neonates** born to women with preterm PROM and is associated with a higher risk of adverse neonatal outcomes and severe morbidity.



Background and Rationale of Study

In current scenario, diagnosis of FIRS is made:

- antenatally by invasive procedures like amniocentesis or cordocentesis: limited clinical application due to procedural complications
- postnatally through histopathological examination of the umbilical cord.
- **Fetus is already affected** with severe short-term and long-term sequelae at time of diagnosis.

NEED OF THE HOUR

Non-invasive method to study fetuses at risk of development of FIRS and identify the pathologic entity
The fetal kidneys are highly susceptible to inflammatory changes in FIRS where systemic redistribution of blood flow occurs which compromises renal perfusion and urine production and results in oligohydramnios.

Aim of study

To find association between Fetal Renal Artery Doppler Indices and Fetal Inflammatory Response Syndrome (FIRS) in cases of Preterm PROM

Objectives:

- To measure fetal renal artery Doppler indices, i.e., Resistive Index (RI) and Pulsatility Index (PI) in cases of PPROM and find its association with fetal inflammatory response syndrome
- To find correlation between fetal renal artery Doppler indices and fetal urine production rate

Study Methodology:

160 cases with PPROM were considered for the study

Expectant Management was done as per hospital protocol
Serial weekly ultrasonographic assessment of the following parameters was done till delivery:

- Fetal renal artery Pulsatility Index (PI)
- Fetal renal artery Resistive Index (RI)
- Fetal bladder volume measurements for calculation of fetal urine production rate

Delivery was undertaken with:

- Onset of spontaneous labor
- Features suggestive of chorioamnionitis
- 34 completed weeks period of gestation
- Evidence of fetal compromise

Samples were collected at delivery:

- 3mL of cord blood for IL-6 levels
- Placental membranes for culture and sensitivity
- Placental membrane and cord for histopathology

Classification of study population based on serum IL-6 levels and presence of histologic evidence of FIRS

FIRS group (n=103)

Non-FIRS group (n=57)

PARAMETERS	FIRS	Non-FIRS	p-value
Fetal Renal Artery PI (FRPI)	2.93 ± 0.08	2.41 ± 0.11	<0.001
Fetal Renal Artery RI (FRRRI)	0.96 ± 0.04	0.88 ± 0.03	<0.001
FUPR (mL/hr)	13.42 ± 4.40	26.26 ± 3.89	<0.001
Reduced FUPR (<5th centile as per gestational age)	102 (99%)	3 (5.3%)	

Table 1: Association between fetal renal doppler indices and FIRS

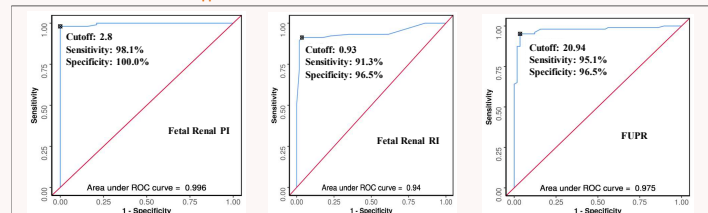


Figure 1: Receiver-operating characteristic curve area (AUC) for predictive analysis of FIRS

RESULTS:

- Prevalence of FIRS in PPROM in our study was **64.37%**
- Neonates with FIRS had a **lower birth weight** requiring NICU admission with a prolonged NICU stay of 12.17 ± 7.93 days.

- Fetuses affected with FIRS had significantly **raised Fetal Renal Doppler Indices- PI & RI** and subsequently **reduced FUPR antenatally** (Table 1)
- Fetal renal artery Doppler indices was observed to have a **strong negative correlation** with FUPR in patients with PPROM.
- However, the strength of the correlation **weakened in the presence of FIRS** and is **more marked for FRPI**

- **95.1% of neonates** affected with FIRS had **severe neonatal morbidity** compared to 18.6% neonates without FIRS

- **Severe neonatal complications**—including neonatal sepsis (94.2% in the FIRS group vs. 1.8%), RDS (69.9% vs. 14% in non-FIRS), IVH, NEC and neonatal mortality (7.21% vs 1.8% in non-FIRS)—were also found to be **more common in the FIRS group**.

- Fetal renal PI at a cut-off value of 2.8 had diagnostic accuracy of 98.8% for prediction of FIRS, with a sensitivity of 98.1%, specificity of 100%, positive and negative predictive values of 100% and 96.6%, respectively

FUPR	PPROM		FIRS		Non-FIRS	
	FRPI	FRRRI	FRPI	FRRRI	FRPI	FRRRI
Correlation coefficient (r)	-0.75	-0.68	-0.24	-0.27	-0.54	-0.35
p-value	<0.001	<0.001	0.013	0.005	<0.001	0.008

Table 2: Correlation between fetal renal doppler indices and FIRS

DISCUSSION:

- No study has been reported in literature studying association between fetal renal Doppler indices and fetal inflammatory response syndrome in PPROM cases.

- The prevalence of FIRS in PPROM is 64.37% which highlights its significant burden in pregnancies complicated with PPROM

- Funisitis precedes chorioamnionitis, suggesting fetal involvement before manifestation of maternal signs & symptoms of chorioamnionitis

- Neonates affected with FIRS had in-utero raised renal artery Doppler indices and reduced fetal urine production rate

- **Fetal renal artery PI outperformed with the highest diagnostic accuracy at 98.8% followed by FUPR (95.6%) and fetal renal artery RI (93.1%).**

- The strength of our study is its prospective, cross-sectional design with a multidisciplinary approach, use of both IL-6 levels and placental histopathology for FIRS diagnosis, enhancing diagnostic accuracy.

- However, the single-center design may limit the generalizability of the findings with larger studies with more diverse populations needed to further validate the findings

- Future studies can assess whether prenatal Doppler and FUPR findings correlate with postnatal renal function tests and evaluating long-term effects on renal function in neonates with FIRS.

CONCLUSION:

Fetal renal artery Doppler indices holds promise as a valuable non-invasive tool for diagnosing FIRS in pregnancies complicated by PPROM and thus timely intervention can be taken in the form of delivery, thereby improving neonatal outcomes while reducing the risks associated with invasive diagnostic techniques.



If antenatal Doppler can predict FIRS, should we not integrate it into routine care for PPROM pregnancies? Because every baby deserves a fair start—equity in care, innovation in action.

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