به نام خدا

FGR Prognosis and Outcome

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FGR Consequences & Prognosis

Key Influencing Factors

- **Severity** — IUGR grading determines impact on fetal development
- **GA at Onset** — Early (<32 wks) vs. Late (>32 wks) outcomes differ significantly
- **Etiologies** — Genetic, placental, maternal, and fetal factors
- **Preterm Delivery** — FGR with preterm delivery compounds risks

Prognosis Overview

Fetal demise, neonatal death, neonatal morbidity, and abnormal neurodevelopmental outcome are **more common** in growth-restricted fetuses.

The prognosis worsens with:

- Early-onset FGR
- Increasing severity of growth restriction
- Absent or reversed end-diastolic flow on umbilical artery Doppler

Key Insight: The combination of early onset, severe growth restriction, and abnormal Doppler findings carries the highest risk for adverse perinatal outcomes.

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Short-Term Outcomes

Neonatal morbidities, respiratory effects, and metabolic alterations

Short-Term Neonatal Morbidities

34%

Respiratory Distress Syndrome and bronchopulmonary dysplasia

30%

Sepsis — increased infection risk related to depressed immunological state

13%

Retinopathy of Prematurity — vision-threatening complication

Other Common Morbidities

- IVH — ischemic-hypoxic encephalopathy
- Necrotizing enterocolitis
- Hypothermia, altered glucose metabolism, hypocalcemia
- Polycythemia, jaundice

Among children who underwent neurodevelopmental assessment, 12% were diagnosed with **cognitive impairment and/or cerebral palsy**.

Respiratory Outcomes

In the past, FGR infants were considered to have more mature lungs due to intrauterine glucocorticoid exposure. However:

Poor fetal nutrition and oxygenation can:

- Alter surfactant quantity and activity
- Impair alveolar cell proliferation
- Cause atypical elastin production

Risks for Premature SGA Infants

- Neonatal respiratory distress
- Bronchopulmonary Dysplasia
- Asthma and bronchiolitis
- Wheezing at age 3 years

Promising finding: Maternal dietary supplementation with Docosahexaenoic Acid (DHA) can restore normal surfactant quantity, regulate cell proliferation and gene function, modifying lung development.

Antenatal Steroids Considerations

Preclinical and clinical evidence demonstrates antenatal steroids may **exacerbate growth restriction** (particularly repeat doses). Antenatal glucocorticoids may not significantly improve neonatal outcomes in FGR preterm infants and may have **adverse effects on brain development**.

Transient Morbidities & Metabolic Effects

Transient Neonatal Morbidities

- Hypothermia
- Altered glucose metabolism (hypoglycemia, hyperglycemia)
- Hypocalcemia
- Polycythemia
- Jaundice
- Sepsis

Increased infection risk related to depressed immunological state and competence.

Metabolic Alterations

Oxygen and nutrient deprivation from placental insufficiency causes metabolic changes:

- Reduced B-cell mass → increased diabetes risk
- Later obesity and metabolic dysfunction
- Insulin resistance and type 2 diabetes
- Hyperlipidemia, PCOs

Key Association: Poor fetal growth followed by **early accelerated postnatal growth** is linked to later metabolic disease.

Postnatal Interventions

Education

Educated mother about FGR risks and follow-up care

Nutrition

Breastfeeding, adequate nutrition, and healthy diet in childhood

Weight Management

Avoid overweight and monitor growth follow-ups

Monitoring

Blood pressure monitoring and regular growth follow-ups

Lifestyle

Physical exercise starting from early childhood

Pharmacological

Growth hormone and metformin when indicated

03

Long-Term Systemic Effects

Neurological, cardiovascular, and renal consequences of FGR

Neurological Outcomes

FGR is **strongly linked** to suboptimal brain development and long-term neurological dysfunctions in:

- Motor ability
- Cognition and learning
- Behavior

Brain Sparing Effect

FGR infants with MCA and Doppler abnormalities (significant brain sparing) are more likely to have neuropathology and greater brain injury.

Intervention: Dietary supplementation with DHA has been shown to improve neurodevelopmental outcomes in FGR infants.

Renal Outcomes

Adaptive response redistributes blood flow away from peripheral vascular beds, preferentially shunted toward essential organs — termed **"brain sparing."** The shunting of blood flow away from the kidneys contributes to suboptimal renal development.

Animal Model Evidence

Animal models of FGR present:

- Reduced number of nephrons
- Suboptimal renal development
- Reduced nephron endowment

Clinical Studies

Clinical evidence demonstrates:

- Impaired renal anatomy and function
- Greater risk of hypertension
- Progressive renal failure

Takeaway: Renal impairment from FGR is now recognized as a significant contributor to long-term hypertension and progressive renal disease.

Cardiovascular Outcomes

Sustained vasoconstriction of peripheral vascular beds alters local arterial wall properties including **endothelial vasodilator dysfunction** and **sympathetic hyperinnervation**, contributing to cardiac remodeling.

FGR Has Been Associated With

- Increased blood pressure and heart rate
- Early atherosclerosis
- Abnormal aortic and carotid wall thickness
- Cardiac dysfunction during adulthood

Management Recommendations

- Avoid overweight
- BP monitoring
- Healthy lifestyle (no alcohol, tobacco)
- Physical exercise

Clinical Significance: Cardiovascular changes in FGR represent one of the most significant long-term sequelae requiring lifelong monitoring.

Maternal Outcomes & Summary

The birth of a newborn with idiopathic growth restriction may be predictive of increased long-term maternal cardiovascular risk: coronary artery disease, myocardial infarction, peripheral arterial disease, TIA/stroke. A systematic review of 10 cohort studies found increased CVD morbidity and mortality (OR **1.09–3.50**).

Comprehensive Outcomes Summary

Period	Cardiovascular	Respiratory	Neurological	Other
Neonatal	Early hypotension, PPHN, structural heart changes, vessel wall rigidity, late systemic hypertension	Increased need for ventilator support, meconium aspiration, pulmonary hemorrhage, BPD	Perinatal asphyxia, microcephaly, IVH, PVL, white matter changes, EEG abnormalities	Hypoglycemia, hypocalcemia, hypothermia, sepsis, jaundice, polycythemia, NEC
Long-Term	Hypertension, ischemic heart disease, stroke, atherosclerosis, cardiac dysfunction	Chronic respiratory insufficiency, reactive airway disease, asthma	Neurodevelopmental issues, behavioral problems, learning difficulties, cerebral palsy	Obesity, metabolic syndrome, insulin resistance, renal issues, shortened lifespan

Prenatal Interventions

Early Detection & Screening

- Early detection of fetal growth restriction
- Regular ultrasound monitoring
- Doppler assessment of umbilical and uterine arteries

Dietary & Lifestyle Modifications

- Mediterranean diet
- Supplementations during pregnancy
- Avoidance of alcohol and tobacco
- Stress reduction

Medical Management

- Normalization of body weight
- Glycemia control
- Blood pressure control

Chronic Disease Management

- Management of maternal chronic diseases
- Treatment of underlying conditions
- Multidisciplinary care approach

Goal: Optimize maternal health before and during pregnancy to reduce FGR incidence and severity.

04

Interventions & Research

Postnatal and prenatal interventions, emerging research, and maternal implications

Emerging Research Directions

Pre-probiotics — potential interventions needing further studies

Lactoferrin and stem cell administration — currently under investigation

Sildenafil citrate — prolonged nitric oxide release leading to vasodilation

VEGF injection into uterine arteries — vascular endothelial growth factor therapy

Intra-amniotic IGF-1 — insulin-like growth factor-1 administration

Antioxidants — Allopurinol and vitamin C

Melatonin — maternal administration

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.و پایان هر مسیر، آغازی دیگر است

The end of speech is the beginning of thought,

and the end of every path is another beginning.

Thank You

Dr. Sh. Roozmeh