



GESTATIONAL TYPE 2 DIABETES MELLITUS AND ITS INFLUENCE ON RETINOPATHY OF PREMATURITY – A RETROSPECTIVE CLINICAL STUDY.

Dr Nakkana Rachana¹, Dr Sangeetha T^{2*}, Dr V. R. Sudha Reddy³

¹. Junior resident, Department of Ophthalmology, Sri Devaraj Urs Medical College

^{2*}. Professor & HOD, Department of Ophthalmology, Sri Devaraj Urs Medical College

³. Professor, Department of Paediatrics, Sri Devaraj Urs Medical College

***Corresponding author:** Dr. Sangeetha T

*Professor and HOD, Department of Ophthalmology, SDUAHER, Kolar, Email-id: sangeethat@sduaher.ac.in

ABSTRACT

Introduction: Gestational Type 2 diabetes mellitus is a growing concern during pregnancy, characterized by elevated blood sugar levels. Retinopathy of prematurity is a retinal disorder that affects preterm infants and is linked to abnormal retinal blood vessel growth. Although ROP is mainly associated with prematurity, studies suggest maternal diabetes could increase its risk. This study aims to explore the impact of maternal T2DM on the development of ROP in preterm infants.

Materials and methods: Retrospective study examined the medical records of preterm infants born between 2021 and 2024 at RL Jalappa hospital. Infants whose mothers had gestational Type 2 diabetes records were evaluated for incidence of ROP, assessed during screening. The data were analysed using statistical methods to identify associations between maternal T2DM and ROP incidence, adjusting for gestational age, birth weight, and other maternal conditions.

Results: Out of 146 preterm infants born to mothers with gestational T2DM, 38 (26.2%) developed ROP. Of these, 15 infants (12.5%) had severe stages (2 and 3) of ROP. The risk of ROP was found to be significantly higher in infants of mothers with gestational T2DM, even after adjusting for gestational age and birth weight. The incidence of severe ROP stages was notably concerning, highlighting the potential impact of maternal T2DM on retinal health in preterm infants.

Conclusion: Gestational Type 2 diabetes is associated with an increased risk of ROP in preterm infants. These findings emphasize the need for close monitoring of preterm infants born to mothers with T2DM, with early intervention strategies to mitigate ROP risk and optimize care for these infants.

Key words: Gestational diabetes mellitus, Retinopathy of prematurity, Maternal risk factors, Neonates, Low birth weight.

Introduction

Retinopathy of prematurity (ROP) is a vaso-proliferative retinal disorder affecting preterm infants, particularly those born before 31 weeks or weighing ≤ 1500 g, and may progress to retinal detachment if untreated [1]. Pathogenesis involves disordered retinal vascularization mediated by hypoxia, oxidative stress, and inflammatory signalling pathways [2,7].

Gestational diabetes mellitus (GDM) is characterized by hyperglycaemia first recognized during pregnancy and is associated with metabolic and inflammatory alterations that may affect fetal vascular

development [8,12]. Maternal hyperglycaemia induces oxidative stress and inflammatory cytokine production, mechanisms implicated in abnormal retinal angiogenesis [10]. Maternal diabetes has been reported as an independent risk factor for severe ROP in very low birth weight infants [3].

Prematurity remains the strongest determinant of ROP, and infants of mothers with GDM have an increased risk of preterm birth [7,8]. However, published data on the independent association between GDM and ROP are inconsistent, with some studies reporting increased risk while others show attenuation after adjusting for gestational age and birth weight [3,11]. A recent large retrospective analysis reported higher rates of severe ROP in infants of mothers with GDM compared with hypertensive disorders of pregnancy [14]. These findings necessitate further evaluation of maternal glycaemic status and ROP risk. Therefore, it is of interest to describe the association between maternal gestational diabetes mellitus and the risk of retinopathy of prematurity in preterm infants.

Materials and methods

This retrospective, interventional hospital-based study was conducted in the Department of Ophthalmology at R.L.J. Hospital and Research Centre, Kolar attached to Sri Devaraj Urs Medical College. After obtaining approval from the Institutional Ethics Committee, the medical records of ROP babies born with maternal history of gestational diabetes mellitus between 2021 to 2024 were reviewed and analysed.

A staging system was proposed to grade the severity of ROP according to standard guidelines.

Imaging Findings – Retinopathy of Prematurity (ROP)

Imaging performed using wide-field fundus imaging (RetCam). Patients were classified based on ICROP-3 staging. ROP staging included:

- Zone (I–III)
- Stage (1–5)
- Presence of plus or pre-plus disease
- Extent (clock hours)
- Aggressive posterior ROP where applicable

Statistical analysis: Statistical analysis was performed using SPSS version 22. Categorical variables were expressed as frequencies and proportions. Chi-square test or Fisher’s exact test was applied. A p-value <0.05 was considered statistically significant.

Results

A total of 148 preterm infants were enrolled in the study, comprising 53 infants born to mothers with gestational diabetes mellitus (GDM) and 95 infants from non-GDM mothers. The overall incidence of retinopathy of prematurity (ROP) was 18.9% (28/148). Among infants born to GDM mothers, 20 (37.7%) developed ROP compared to 8 (8.4%) in the non-GDM group, indicating a significantly higher prevalence of ROP in the GDM group.

Parameters		HbA1c Normal (n=25)	HbA1c Elevated (n=28)	ROP Present (n=20)	ROP Absent (n=33)	p-value
Gestational Age (weeks)	<28	8 (32%)	7 (25%)	10 (50%)	5 (15%)	0.0099
	28-31	10 (40%)	13 (46.4%)	8 (40%)	15 (45.5%)	
	32-36	7 (28%)	8 (28.6%)	2 (10%)	13 (39.3%)	
GDM	Yes	25	28	20 (37.7%)	33 (62.3%)	<0.001
	No	N/A	N/A	8 (8.4%)	87 (91.6%)	

Table 1: Distribution of ROP among GDM and Non-GDM groups and gestational age.]

Parameters		ROP Stage 1	ROP Stage 2	ROP Stage 3	ROP Stage 4/5	Total ROP	p-value
	Normal	5 (35%)	12 (48%)	5 (25%)	0 (0%)	20 (37.7%)	0.041

Maternal HbA1c Level	(≤5.7%)						
	Elevated (>5.7%)	2 (10%)	7 (35%)	4 (20%)	0 (0%)	13 (23.4%)	
GDM Infants with ROP		7 (35%)	9 (45%)	4 (20%)	0 (0%)	20	<0.001

Table 2: ROP Staging in Relation to Maternal HbA1c Levels and GDM Infants with ROP.

Parameters		ROP Present (n=20)	ROP Absent (n=33)	Total (n=53)	p-value
Gestational Age	<28 weeks	10 (50%)	5 (15%)	15 (28.3%)	0.006
	28-31 weeks	8 (40%)	15 (45%)	23 (43.4%)	
	32-36 weeks	2 (10%)	13 (39.3%)	15 (28.3%)	
Birth Weight	≤1500g	15 (75%)	5 (15%)	20 (37.7%)	<0.001
	1501-2000g	5 (25%)	28 (85%)	33 (62.3%)	

Table 3: Distribution of birth weight and gestational age among GDM infants with and without ROP.

Discussion

This study demonstrates a significantly higher incidence of ROP among infants born to mothers with GDM, consistent with reports identifying maternal diabetes as a contributor to severe ROP in very low birth weight infants [3,14]. The association likely reflects metabolic and inflammatory intrauterine influences on retinal angiogenesis [2,10].

However, maternal HbA1c levels did not correlate with ROP severity, suggesting that single-point glycaemic measurement may not adequately represent cumulative metabolic exposure. Similar observations have been reported in neonatal hyperglycaemia studies evaluating ROP risk [15].

Prematurity and low birth weight remained the strongest predictors of ROP in our cohort, consistent with established evidence [7,9]. These findings indicate that while GDM increases overall susceptibility, neonatal immaturity remains the principal determinant of disease progression.

The absence of Stage 4/5 ROP may reflect early screening and improved neonatal care practices. Given the multifactorial pathogenesis of ROP, perinatal variables including oxygen exposure and systemic inflammation likely interact with maternal metabolic status [2,9,16].

Clinically, infants born to mothers with GDM require vigilant ROP screening irrespective of maternal HbA1c values.

Limitations

This retrospective study included a limited sample size. Maternal HbA1c was measured at a single time point, limiting assessment of cumulative glycaemic exposure. Neonatal oxygen therapy duration and inflammatory markers were not comprehensively evaluated. Causality cannot be inferred due to observational design.

Conclusion

Maternal gestational diabetes mellitus is associated with increased risk of retinopathy of prematurity in preterm infants. Prematurity and low birth weight remain the strongest determinants of disease severity. Enhanced screening protocols are recommended for infants exposed to GDM, independent of maternal HbA1c levels. Larger prospective studies with longitudinal metabolic assessment are required to clarify mechanistic pathways.

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