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Maternal-Child Blood Group Discordance & Congenital Heart Disease Severity: An Immunological Risk Perspective from a Tertiary Hospital-Based Study

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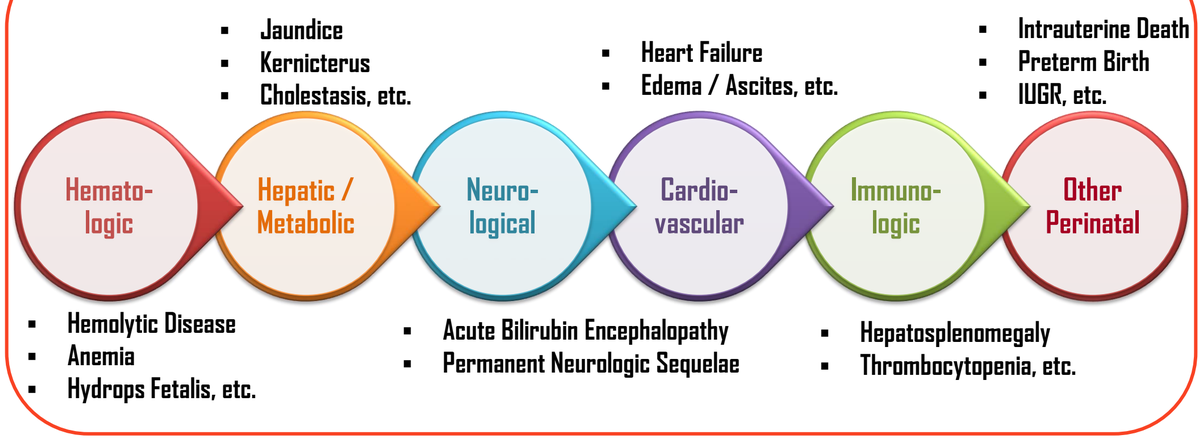
INTRODUCTION

- ✓ Congenital heart disease (CHD) affects *~1 % of all live births*, with outcomes influenced by both anatomical complexity and clinical severity.[1]
- ✓ While genetic and environmental factors are well-recognized, *the role of maternal-foetal immuno-haematological interactions—particularly ABO and Rh incompatibility—remains underexplored*, despite their known impact in haemolytic disease of the newborn.[2]

Fig 1: Complications Associated with Maternal-Fetal Blood Group Incompatibility



- ✓ Prior studies suggest a link between ABO blood groups and CHD risk.[3] Still, evidence on ABO and Rh discordance is limited and inconclusive, with *no research yet examining their association with CHD severity*.[4,5]

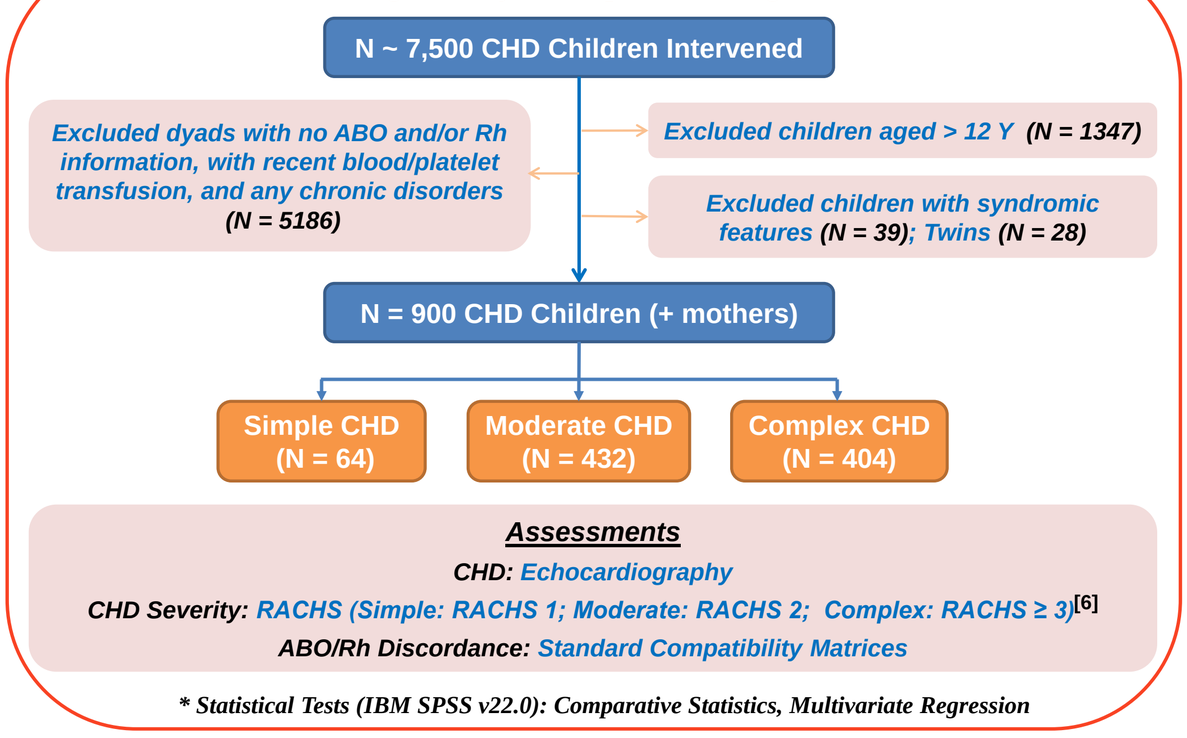
OBJECTIVE

To investigate the association between maternal-child blood group compatibility patterns (ABO and Rh), and the severity of CHD in affected children

METHODOLOGY

- ✓ Design: *Retrospective Cross-Sectional Observational Study*
- ✓ Participants: *Indian mother-child dyads underwent surgical correction for CHD*
- ✓ Duration: *March 2022 to July 2025*
- ✓ Site: *Sri Sathya Sai Sanjeevani Hospital- A free-of-cost tertiary cardiac centre*
- ✓ IEC Approved with Informed Consent

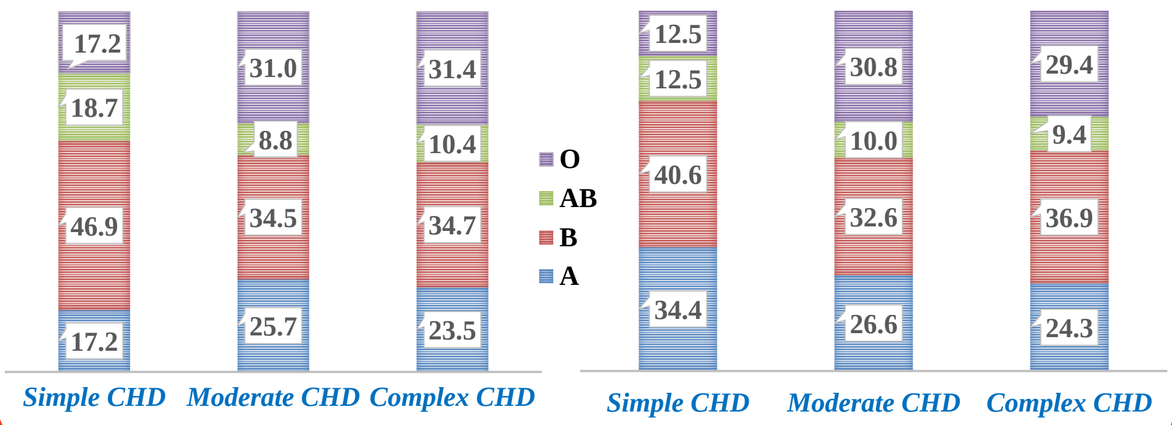
Fig 2: Study Participants & Design



** Statistical Tests (IBM SPSS v22.0): Comparative Statistics, Multivariate Regression*

RESULTS & DISCUSSION

Fig 3: Distribution (%) of ABO Blood Groups



[A] Mothers *(p = 0.034)* [B] Children *(p = 0.089)*

Fig 4: Rh (-) Distribution

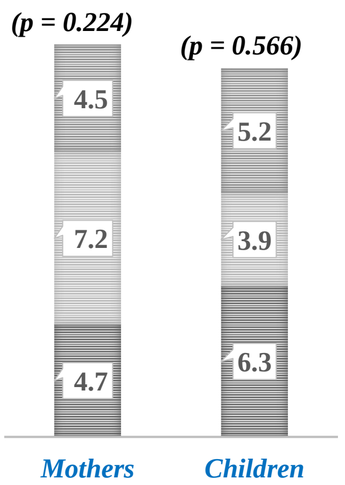


Table 1: Association Between ABO, Rh Factors & CHD Severity

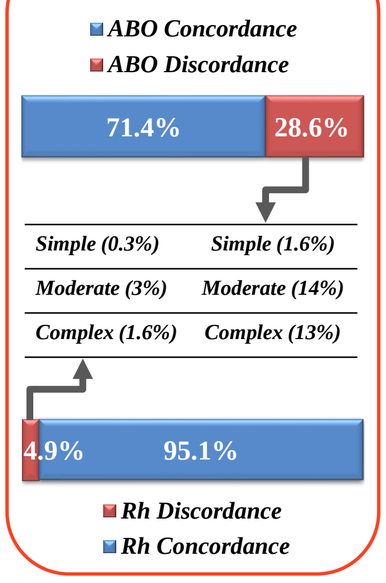
Variables	Adjusted Odds Ratio (95% CI)	
	Moderate CHD	*Complex CHD*
Maternal ABO Blood Groups (w.r.t. O)		
A	0.83 (0.35-1.98)	0.75 (0.31-1.79)
B	**0.47 (0.29-0.81)***	**0.38 (0.15-0.85)***
AB	**0.25 (0.11-0.70)****	**0.30 (0.10-0.73)****
Maternal Rh Antigen (w.r.t. Rh +)		
Rh Negative	1.57 (0.47-5.29)	0.95 (0.27-3.32)
Child ABO Blood Groups (w.r.t. O)		
A	**0.47 (0.29-0.97)****	**0.31 (0.15-0.79)****
B	**0.31 (0.16-0.77)****	**0.38 (0.16-0.90)***
AB	**0.39 (0.29-0.87)***	**0.36 (0.19-0.85)***
Child Rh Antigen (w.r.t. Rh +)		
Rh Negative	0.62 (0.20-1.89)	0.82 (0.27-2.48)

** p ≤ 0.05; ** p ≤ 0.01*

Table 2: Maternal-Child ABO, Rh Discordance & CHD Severity

Variables	*Moderate CHD*	*Complex CHD*
All Age Group (0 to 12 years)		
ABO Discordance	1.47 (0.78-2.76)	1.46 (0.78-2.73)
Rh Discordance	1.36 (0.39-4.61)	0.73 (0.20-2.61)
0 to 1 years		
ABO Discordance	0.70 (0.18-2.73)	0.68 (0.19-2.45)
Rh Discordance	1.84 (0.09-38.05)	1.82 (0.09-34.23)
>1 to 5 years		
ABO Discordance	**3.35 (1.23-8.85)***	1.23 (0.45-3.38)
Rh Discordance	1.59 (0.20-12.42)	0.76 (0.09-6.44)
>5 to 12 years		
ABO Discordance	1.83 (0.63-5.33)	1.08 (0.36-3.30)
Rh Discordance	0.87 (0.17-4.59)	0.13 (0.01-1.72)

Fig 5: Discordance (%)



Strengths: **Large, clinically well-characterized cohort, standardized RACHS severity classification and robust statistical adjustment**

Limitations: **Single-centre design, potential referral bias and lack of genetic / mechanistic biomarkers to validate causality**

CONCLUSION

- ✓ *First large-scale evidence* **from an Indian cohort showing that** *maternal-child ABO discordance may modulate CHD severity*, **especially in early childhood.**
- ✓ **Highlights the importance of ABO incompatibility profiling for early risk stratification frameworks, particularly in resource-limited clinical settings with high CHD burden.**
- ✓ **Calls for multicentric studies integrating immunology, genomics, and placental biology to uncover underlying mechanisms.**

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