

0178 - EARLY DETECTION OF PEDIATRIC METABOLIC SYNDROME USING RIAO AND MACHINE LEARNING

Mode: Research paper

Thematic Unit: Diabetes Mellitus

Thematic Unit 2: Insulin Resistance

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Background/Objectives: The identification of biomarkers capable of detecting early metabolic dysfunction before overt glycemic deterioration is of growing clinical relevance. The present study explored the potential role of Real hIAPP Amyloid Oligomers (RIO) as a prognostic biomarker of metabolic syndrome in pediatric populations. Objective: To evaluate the potential of RIO as a biomarker associated with the metabolic syndrome phenotype, insulin resistance, and broader cardiometabolic risk in mixed pediatric populations.

Methods: A retrospective observational study using clinical data from three tertiary care centers in Mexico City, with both regression-based and machine learning analytical approaches. The regression-based cohort comprised 31 patients with type 2 diabetes mellitus with complete anthropometric, biochemical, and RIO data, including a longitudinal subgroup of 17 patients with a median follow-up of 34 months. The machine learning cohort included 162 pediatric participants aged 2–18 years (60 with type 1 diabetes mellitus, 47 with obesity, 39 with type 2 diabetes mellitus, and 16 controls), used to train a supervised neural network for metabolic syndrome classification using an independent test cohort of 31 patients. An insulin resistance subset of 72 participants with available HOMA-IR values was used to compare logistic regression, XGBoost, and a feedforward neural network.

Results: In the regression-based cohort of 31 pediatric patients with DM2, RIO was significantly associated with multiple domains of cardiometabolic deterioration, including adiposity, glycemic control, dyslipidemia, hepatic markers, uric acid, creatinine, and thyroid function. Metabolic syndrome was present in 67.7% of this cohort. Longitudinal follow-up in 17 patients confirmed that the high-risk RIO profile remained associated with hepatic steatosis, dyslipidemia, hyperuricemia, and obesity-related markers over a median of 34 months. The metabolic syndrome neural network achieved an AUC of 0.906 in the training cohort (n=162) and 0.97 in the independent test cohort (n=31), with 100% precision and 83% recall in the test set. In the insulin resistance analysis, XGBoost achieved the highest AUROC (0.745 ± 0.021), and RIO ranked as the second most important predictor after HDL cholesterol, ahead of glucose, BMI, ALT, and age. Metabolic syndrome was present in 40.7% of the machine learning training cohort, and insulin resistance was identified in 69.4% of the HOMA-IR subset.



Conclusion: The fact that RIAO ranked second in insulin resistance prediction, ahead of glucose, BMI, and liver enzymes, indicates it encodes biologically distinct information that conventional markers do not fully capture. Pediatric endocrinologists should not have to wait for overt dysglycemia to act — RIAO offers a tool to identify high-risk children earlier and support more targeted clinical decision-making.

