ARTIFICIAL INTELLIGENCE FOR EARLY RISK STRATIFICATION AND TREATMENT OPTIMIZATION IN ADOLESCENT IDIOPATHIC SCOLIOSIS: PRELIMINARY RESULTS FROM A CLINICAL IMPLEMENTATION

Maria Chiara Maccarone, **Elena Barzizza**, **Paola Contessa**, **Gianluca Regazzo**, **Riccardo Ceccato**, **Luigi Salmaso**, **Stefano Masiero**

University of Padua, Italy
e-mail: mariachiara.maccarone@phd.unipd.it

Background and Aims

Adolescent Idiopathic Scoliosis (AIS) is a multifactorial condition characterized by curve progression. Early identification of high-risk patients is important for timely and effective interventions, including bracing and specific rehabilitation programs. Traditional decision-making relies on single clinical parameters, which may not capture the complexity of risk profiles for each patient. Recent advancements in Artificial Intelligence (AI) that can process and analyze large amounts of data offer new possibilities for precision medicine in AIS care. This study aimed to evaluate the real-world applicability of an AI-based predictive model for early risk stratification in AIS and its role in supporting clinicians in personalized therapeutic decision-making.

Methods

A supervised Machine Learning (ML) algorithm was developed and internally validated using clinical and radiographic data from a retrospective cohort of 600 AIS patients. The model integrated demographic, skeletal maturity, and postural parameters to estimate the risk of curve worsening over 12 months. The outcome variable was defined as either an increase in the Cobb angle or, when follow-up radiographs were unavailable, a clinically assessed increase in rib hump during follow-up.

Results

In the ML model, the most influential predictors of AIS worsening were: lower hump at baseline, lower Risser stage, smaller initial Cobb angle, younger age at the time of brace prescription, and brace prescription for 18–24 hours per day.

Conclusion

The integration of AI in the early management of AIS may enhance clinical decision-making by providing individualized risk profiles and suggesting targeted interventions. Our ML model identifies individualized risk profiles and reveals that patients with milder clinical presentations, such as lower Cobb angles and subtle humps, may paradoxically carry a higher risk of curve progression, thus requiring careful therapeutic consideration to avoid undertreatment.

Keywords: artificial intelligence; scoliosis; machine learning.