Title: Using a Machine Learning Algorithm to Predict Accurately Procedural Success After Trans-Catheter Edge-to-edge Repair Using Mitra-Clip.

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Background : The efficacy of trans-catheter edge-to-edge repair using Mitra-clip (MC) depends highly on patient selection and pre-intervention echocardiographic parameters, as highlighted by the opposite results of MITRA-FR and COAPT. Machine learning is a form of artificial intelligence that could assist in making precise predictions of successful MC procedure. This may facilitate the patient selection while transcending the traditional predictive parameters used in these landmark studies.

Methods : Consecutive pre-procedural TEE for assessment of MC performed at our center from 2014-2021 were blindly reviewed for 27 pre-procedural clinical and echocardiographic characteristics. We performed a neural network machine learning algorithm (MLA) using SPSS (V28, IBM, USA) to predict a main outcome of reduction in mitral regurgitation of at least one grade and to mild regurgitation or less. Seventy percent of the sample was used for training, and 30% was used for testing. We used a model having 4 hidden layers with a sigmoid activation function. The output layer with a Softmax activation function with and the error function was with cross-entropy.

Results: Four-hundred patients were included (mean age: 80 ± 10.9 years, 175 females (43.8%)). Most cases were functional (n=232 (58%)) and ≥ 3/4 severity grade (n=360 (90%)). The mean mitral annular area was 8.3± 2.4 cm2 and mean mitral gradient was 1.7 ± 0.9 mmHg. Standard procedural success was achieved in 362 cases (90.5%) and 277 patients met the primary outcome The following pre-procedural variables were identified as having the highest significant normalized predictive importance by the MLA: mean mitral gradient, the anterior and posterior leaflet length in relation to their respective diameter, sex and left atrial indexed volume. The area under curve for the prognostic precision of the MLA for predicting the main outcome was 0.752 (95% CI: 0.699-0.805, $p<0.001$).

Conclusion: This MLA was highly precise in predicting optimal interventional outcomes after MC. It could serve, after external validation, to assist in future patient selection to optimize outcomes during MC.

Figure 1. Receptor Operator Curve of the Neuronal Network's Predictive Capabilities for Predicting the Main Outcome