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External validation of cerebral aneurysm rupture probability model with data from two patient cohorts – Supplementary Material

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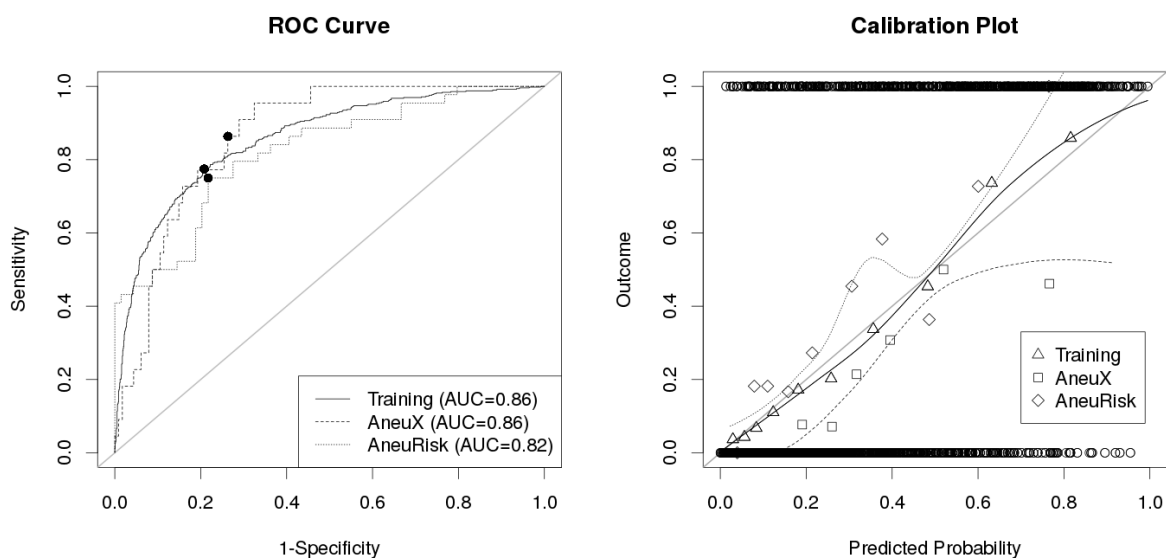


Figure 1 ROC-curves and calibration plots for the training data (solid line), *AneuX*, and *AneuRisk* data (dotted lines). The filled circles on the ROC curve indicate the values corresponding to the “optimal threshold” determined for the respective data. The circles at the top and bottom of the calibration plot show the observed data. The triangles, squares, and rhombuses show the observed outcomes of the training and test populations grouped by deciles, which are also represented by the loess smoother with the solid and dotted lines.

Table 1 Accuracy measures for the model applied to the training and testing populations combining *AneuRisk* and *AneuX* data (“Test”) as well as separately for given threshold. Thresholds marked with an asterisk are “optimal threshold” based on the ROC curve of the given dataset. TPR=ratio of true to all positives (=sensitivity), FPR = ratio of false positives to all negatives (= 1-specificity), PPV (positive predictive value=precision) = ratio of true positives to number of true and false positives, NPV (negative predictive value) = ratio of true negatives to number of true and false negatives, misclassification error = number of incorrect classifications divided by the sample size

Data	Threshold	TPR	FPR	PPV	NPV	Misclassification error
Training	0.323*	0.77	0.21	0.62	0.89	0.21
Test	0.316*	0.77	0.24	0.54	0.90	0.24
Test	0.323	0.76	0.23	0.54	0.90	0.23
AneuRisk	0.316*	0.75	0.22	0.69	0.83	0.23
AneuRisk	0.323	0.75	0.22	0.69	0.83	0.23
AneuX	0.305*	0.86	0.26	0.39	0.97	0.24
AneuX	0.323	0.77	0.24	0.39	0.95	0.24

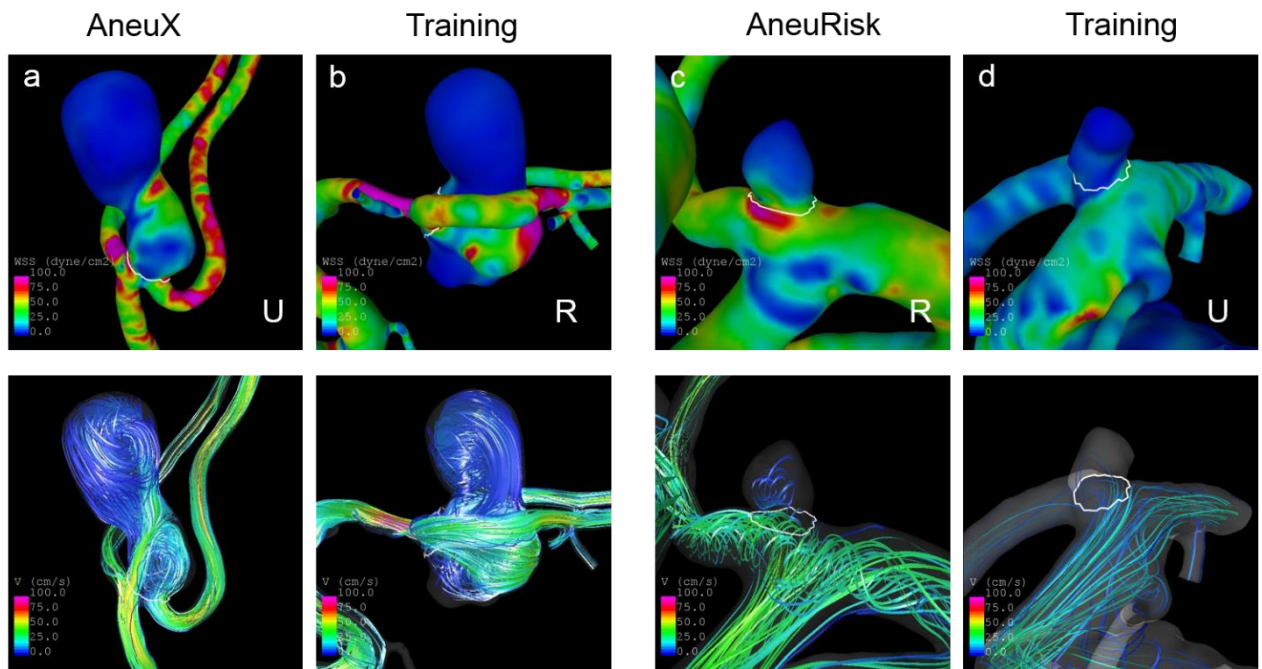


Figure 2 Wall shear stress distribution (top panel) and streamlines (bottom) at half of the cardiac cycle of two misclassified cases (*a* and *c*) and their corresponding similar cases (*b* and *d*). Case *a* was unruptured, but classified by both the model and the data-driven approach as ruptured, whereas *c* was ruptured, but classified as unruptured. The predicted probabilities and values of selected variables for these cases are shown in Tab. 2

Table 2 Values of selected variables and predicted probabilities of being ruptured based on the statistical model for the IAs illustrated in Fig. 2. ACOM = anterior communicating artery, ICA-BIF = internal carotid artery bifurcation

Case	Population	Asize [cm]	Location	NSI	OSImax	Pred. Prob	Rupture Status
a	Test	1.9454	ACOM	0.3414	0.4675	0.8592	U
b	Training	1.6427	ACOM	0.3013	0.4820	0.7803	R
c	Test	0.4169	ICA-BIF	0.1753	0.1473	0.0806	R
d	Training	0.3817	ICA-BIF	0.2059	0.1462	0.1333	U