Application of artificial neural networks for the prediction of lymph node metastases to the ipsilateral axilla - initial experience in 194 patients using magnetic resonance mammography.

In breast MRI (bMRI), prediction of lymph node metastases (N+) on the basis of dynamic and morphologic descriptors of breast cancers remains a complex task. To predict N+ using an artificial neural network (ANN) on the basis of 17 previously published descriptors of breast lesions in bMRI. Standardized protocol and study design were applied in this study (T1w-FLASH; 0.1 mmol/kg body weight Gd-DTPA; T2w-TSE; histological verification after bMRI). All lesions were evaluated by two experienced radiologists in consensus. In every lesion 17 previously published descriptors were assessed. Matched subgroups with (N+: n=97) and without N+ were created (N-: n=97), forming the dataset of this study (n=194). An ANN was constructed ("Multilayer Perceptron"; training: "Batch"; activation function of hidden/output layer: "Hyperbolic Tangent"/"Softmax") to predict N+ using all descriptors in combination on a randomly chosen training sample (n=123/194) and optimized on the corresponding test sample (n=71/194) using dedicated software. The discrimination power of this ANN was quantified by area under the curve (AUC) comparison (vs AUC=0.5). Training and testing cycles were repeated 20 times to quantify the robustness of the ANN (median-AUC; confidence intervals, CIs). The ANN demonstrated highly significant
discrimination power to classify N+ vs N- (P<0.001). Diagnostic accuracy reached "moderate" AUC (median-AUC=0.74; CI 0.70-0.76). Application of ANNs for the prediction of lymph node metastases in breast MRI is feasible. Future studies should evaluate the clinical impact of the presented model.