**SPECIFICITY OF SALIVARY GLAND ULTRASOUND IN THE DISCRIMINATION OF PRIMARY SJÖGREN’S SYNDROME FROM UNDIFFERENTIATED CONNECTIVE TISSUE DISEASES**

**Keywords:** Imaging

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**Background:** Recently, compelling data have been published on the value of salivary gland ultrasound (SGUS) in differentiating between primary Sjögren’s Syndrome (SS) from non-immune-mediated sicca syndrome. Limited data are available regarding the diagnostic accuracy of SGUS to distinguish SS from undifferentiated connective tissue diseases associated with sicca syndrome.

**Objectives:** The aim of this study was to evaluate the power of SGUS to distinguish patients with SS from those with xerostomia and/or xerophthalmia and suffering from undifferentiated connective tissue diseases.

**Methods:** Our cross-sectional study consecutively recruited 95 patients with either SS (according to the American European Consensus Group criteria) or undifferentiated connective tissue diseases associated with sicca syndrome. Immunological assessment and salivary gland biopsies were performed in all patients. Ultrasonography of the parotid and submandibular glands on both sides were assessed for size, parenchymal echogenicity, and inhomogeneity, by the same blinded rheumatologist. A second ultrasound reading was performed blinded by another rheumatologist, with inter-observer Kappa calculation. Ultrasound abnormalities of the salivary glands were graded according to the OMER-ACT score ranging from 0 to 3 (threshold ≥2).

**Results:** The study included 95 patients; 51 with SS and 44 with undifferentiated connective tissue disease. Patients with SS showed a higher SGUS score compared with those with rheumatism with sicca syndrome (mean 1.69 (SD=1.17) versus 0.18 (SD= 0.44), P < 0.0001). The SGUS threshold showed a sensitivity of 60%, a specificity of 98%, a positive predictive value of 97% and a negative predictive value of 67% for the diagnosis of SG. A significant correlation was also found between the SGUS score and the minor salivary gland biopsy focus score (r=0.64, P<0.0001). Finally, the inter-observer Kappa coefficient ranged from 0.61 to 0.70.

**Conclusion:** Our study confirmed the good sensitivity and high specificity of SGUS in differentiating SS from other undifferentiated connective tissue diseases with sicca syndrome.

**REFERENCE:**


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**Disclosure of Interests:** None declared.

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**AUTOMATIC SCORING OF EROSION, SYNOVITIS AND BONE OEDEMA IN RHEUMATOID ARTHRITIS USING DEEP LEARNING ON HAND MAGNETIC RESONANCE IMAGING**

**Keywords:** Artificial intelligence, Imaging, Rheumatoid arthritis

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**Background:** Rheumatoid Arthritis (RA) Magnetic Resonance Imaging (MRI) scoring system (RAMRIS) [1] is used to manually assess severity of disease activity and monitor treatment response, but it is dependent on observer variability and is time-consuming. Deep learning techniques have the potential to improve the reproducibility and efficiency of RAMRIS scoring by automating the analysis of hand MRI scans, however, there are limited data on an automated assessment approach.

**Objectives:** To investigate whether a deep neural network (DNN) can be trained to automatically detect erosion, synovitis, and oedema in RA patients using hand MRI scans and RAMRIS.

**Methods:** We used 1,5 Tesla hand MRI (Siemens Magnetom Vida and Aera) from the BARÉ BONE trial, a prospective, single-arm, interventional, open-label, phase 4 trial (EUDRACT 2016-001164-32) in which RA patients were treated with baricitinib (4mg/day) for 48 weeks. One of the objectives of BARÉ BONE was to assess the effect of baricitinib on joint damage and synovial inflammation. Participants of BARÉ BONE received hand MRI at week 0, 24, 48 following a standardized scanning protocol [2]. All images were scored according to RAMRIS. DNNs were applied on coronal T1 (pre/post contrast enhancement) and T2 MRI images. 3-D landmarks for each location for RAMRIS scoring were identified, and a region of interest (ROI) was used. Each DNN was based on a ResNet3D [3] architecture that was pretrained on a video classification task [4]. The networks were trained to predict the severity scores of each disease characteristic into three classes ranging from 0 (no pathological change) to 2 (high disease burden). The performance of the DNNs was evaluated using the area under the receiver operating characteristic curve (AUROC) and the area under the precision-recall curve (PR-AUC). Three-fold cross-validation was used and the network performance on a hold-out test set was evaluated.

**Results:** In total, we obtained 212 coronal MRI images with both T1 and T2 weighting from 30 RA patients (24 woman/6 men, age 53.5±12.6 years, disease duration 43.4±4.4 years). The overall RAMRIS score decreased from 20.6 (CI95% 14.4 to 27.8) to 18.3 (CI95% 11.5 to 26.3) at week 48. For the evaluation of erosions and oedema, 23 landmarks respectively were used per hand, and 7 landmarks for synovitis. In total 4608 landmarks for erosion and oedema were available, and for synovitis 1152 landmarks. The AUROC for predicting erosions was 86±2% with a PR-AUC of 83±4%. For the prediction of oedema the AUROC was 78±14% and PR-AUC was 83±10%. Despite a low number of ROI for synovitis scoring, the respective AUROC was 60±4% and PR-AUC was of 69±3%.

**Conclusion:** This proof-of-concept study demonstrated that fully automated extraction of synovitis, bone oedema, and erosion is feasible. In the future, our deep neural network approach may help to automatically assess MRI data of the hand in routine clinical practice and trials with high accuracy while keeping costs and human resources manageable.

**REFERENCES:**


**Figure 1.** Neural network pipeline. Region of interests required for RAMRIS scoring are extracted from hand MRI images. All region of interests required are fed into a ResNet3D to detect erosion, synovitis and bone oedema, respectively.

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Table 1. Performance according to the intensity of B-mode ultrasound echovitreous:

<table>
<thead>
<tr>
<th>Echovitreous grades</th>
<th>Sensitivity (IC95%)</th>
<th>Specificity (IC95%)</th>
<th>NPV (IC95%)</th>
<th>PPV (IC95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+2+3</td>
<td>0.69 (0.44-0.94)</td>
<td>0.41 (0.32-0.50)</td>
<td>0.12 (0.05-0.19)</td>
<td>0.92 (0.84-1.00)</td>
</tr>
<tr>
<td>2+3</td>
<td>0.46 (0.32-0.50)</td>
<td>0.67 (0.59-0.76)</td>
<td>0.14 (0.04-0.24)</td>
<td>0.92 (0.86-0.98)</td>
</tr>
<tr>
<td>3</td>
<td>0.08 (0.00-0.22)</td>
<td>0.96 (0.92-0.99)</td>
<td>0.17 (0.00-0.46)</td>
<td>0.90 (0.85-0.95)</td>
</tr>
</tbody>
</table>

Figure 1. Patients with axial spondyloarthritis and psoriatic arthritis: Echovitreous intensity by B-mode ultrasound through color map and histogram: A. grade 0; B. grade 1; C. grade 2; D. grade 3.

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