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Original article

# Pulmonary magnetic resonance imaging is similar to chest tomography in detecting inflammation in patients with systemic sclerosis

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ABSTRACT

Interstitial lung disease (ILD) and pulmonary arterial hypertension (PAH) are prevalent complications of systemic sclerosis (SSc) and are currently the leading causes of death related to the disease. The accurate recognition of these conditions is therefore of utmost importance for patient management.

A study was carried out with 24 SSc patients being followed at the Rheumatology Department of the Hospital de Clínicas of Universidade Federal do Paraná (UFPR) and 14 healthy volunteers, with the objective of evaluating the usefulness of lung magnetic resonance imaging (MRI) when assessing ILD in SS patients. The results obtained with lung MRI were compared to those obtained by computed tomography (CT) of the chest, currently considered the examination of choice when investigating ILD in SS patients.

The assessed population was predominantly composed of women with a mean age of 50 years, limited cutaneous SS, and a disease duration of approximately 7 years. In most cases, there was agreement between the findings on chest CT and lung MRI. Considering it is a radiation-free examination and capable of accurately identifying areas of lung tissue inflammatory involvement, lung MRI showed to be a useful examination, and further studies are needed to assess whether there is an advantage in using lung MRI instead of chest CT when assessing ILD activity in SS patients.



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## Ressonância magnética pulmonar é semelhante à tomografia de tórax para detectar inflamação em pacientes com esclerose sistêmica

*Palavras-chave:*
Esclerose sistêmica
Ressonância magnética
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RESUMO

A doença intersticial pulmonar (DIP) e a hipertensão arterial pulmonar (HAP) são complicações prevalentes na esclerose sistêmica (ES) e constituem atualmente as principais causas de morte relacionadas à doença. O reconhecimento preciso dessas condições é, portanto, de fundamental importância no manejo dos pacientes.

Fez-se um estudo com 24 pacientes com ES em acompanhamento no serviço de reumatologia do Hospital de Clínicas da Universidade Federal do Paraná (UFPR) e 14 voluntários sadios com objetivo de avaliar a utilidade do exame de ressonância magnética (RM) do pulmão na avaliação da DIP em pacientes com ES. Os resultados obtidos com a RM pulmonar foram comparados com os obtidos na tomografia computadorizada (TC) de tórax, exame atualmente considerado de eleição na investigação da DIP em pacientes com ES.

A população avaliada era predominantemente composta por mulheres com idade média de 50 anos, ES cutânea limitada e tempo de doença de aproximadamente sete anos. Na maioria dos casos, houve concordância entre os achados na TC de tórax e RM do pulmão. Em se tratando de um exame isento de radiação e capaz de identificar com adequada precisão áreas de acometimento inflamatório do tecido pulmonar, a RM do pulmão de revelou um exame útil. São necessários mais estudos para avaliar se há vantagem da RM do pulmão sobre a TC de tórax na avaliação da atividade da DIP em pacientes com ES.



## Introduction

Systemic sclerosis (SSc) is an autoimmune disease of unknown origin and worldwide distribution that predominantly affects women in the third or fourth decades of life, which is characterized by fibrosis of the skin and internal organs, vasculopathy and immune dysregulation.[1,2]

SSc has high morbidity and mortality, with pulmonary involvement in the form of interstitial lung disease (ILD) and/or pulmonary arterial hypertension (PAH) being the main cause of death in this disease.[3,4]

ILD is a fairly common complication of SSc, present in approximately 50% of patients with diffuse cutaneous SSc and in up to a quarter of patients with limited cutaneous SSc.[5,6] In SSc, the most frequent pattern of interstitial lung involvement is nonspecific interstitial pneumonia (NSIP), characterized by the presence of ground-glass opacity, representing inflammatory involvement of lung tissue (alveolitis), and traction bronchiectasis and bronchiolectasis, which correspond to pulmonary parenchymal fibrosis. In NSIP, pulmonary involvement predominantly affects the lower lobes, is bilateral and symmetrical, and commonly shows an adequate response to immunosuppressants.[3,7]

Therefore, as the treatment of ILD in SSc involves the use of immunosuppressants, these should be initiated early during disease evolution, i.e., in pre-fibrotic stages, in cases with inflammatory involvement (alveolitis) of the lung parenchyma. Likewise, it is plausible to consider that the immunosuppressive treatment, which is not free of complications and side effects, should only be maintained as long as there is an inflammatory substrate which it can act upon.

Several methods are available for the evaluation of ILD in SSc, with chest CT being the one most commonly used test (the "gold standard"). It is a fast, widely available examination and its high resolution allows an excellent analysis of the lung parenchyma when compared, for instance, to a plain chest X-ray. However, in comparison to the latter, it involves a much higher dose of radiation.[8]

Complementing the chest CT findings, pulmonary function tests, including spirometry, lung volume determination, carbon monoxide diffusion capacity measurement and the 6-minute walking test are also performed in the ILD investigation.

To identify areas of pulmonary inflammation, magnetic resonance imaging (MRI) presents as a promising examination.[9–11] Regarding the examination technique, one can identify, according to the tissue characteristics (hydrogen proton organization, response to the magnetic field and the radiofrequency stimulus), relaxation times T1, T2 and density of hydrogen protons (DP), with these being the parameters that yield image brightness or signal. By choosing the parameters of each sequence, it is possible to weight the image in T1, T2 and other types of sequence, allowing the differentiation between normal and pathological tissues. Commonly, there is an increase in T2 signal in pathological processes.[12] In pulmonary MRI, the low density of protons, which generates a low-density signal, and multiple air–tissue interfaces (susceptibility artifact), as well as movement artifacts (respiratory, cardiac, and vascular), are great challenges.[13] However, MRI is a non-invasive, relatively high-resolution, ionizing radiation-free examination.

However, in the field of SSc, few studies have reported on MRI use for the evaluation of ILD, which is more commonly used to analyze cardiac involvement in the disease.[14] The theoretical basis for performing MRI in the assessment of ILD in patients with SSc would be the increase in the number of

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