From Images to Better Decisions: How Technology Can Improve the Diagnosis of Spondyloarthritis

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Imaging plays a central role in the diagnosis of axial spondyloarthritis (axSpA) and in the assessment of axial involvement in psoriatic arthritis (PsA). Magnetic resonance imaging (MRI) can identify bone marrow edema—the principal imaging manifestation of active inflammation in the sacroiliac joints and spine—before definite radiographic damage develops. However, bone marrow edema is not disease-specific and can also result from mechanical stress, pregnancy, anatomical variation or degeneration. The emerging paradigm is therefore moving away from the isolated search for inflammation towards the simultaneous assessment of active inflammatory and structural lesions, interpreted within the clinical context.[1] This distinction has direct clinical consequences: an incorrect diagnosis may lead to inappropriate immunomodulatory treatment, whereas failure to identify true inflammation may delay effective therapy. Correctly distinguishing inflammatory disease from its mimics is also essential when interpreting treatment non-response and estimating prognosis.[2]

Technological advances are changing both image acquisition and the information that can be extracted from imaging. A recently evaluated high-resolution, deep-learning-reconstructed Dixon MRI sequence provided diagnostic performance non-inferior to a standard multisequence sacroiliac-joint MRI protocol while reducing acquisition time by 73%.[3] Faster protocols could improve access, reduce motion artefacts and make comprehensive MRI more feasible in routine care. At the same time, artificial intelligence (AI)-assisted generation of synthetic computed tomography (CT) images from MRI offers CT-like visualization of bony changes without an additional radiation-based examination. AI-supported reconstruction of low- and ultra-low-dose CT may further improve assessment of structural damage in the sacroiliac joints and spine while limiting radiation exposure.[4]

Technology can also connect expertise across geographical boundaries. In the prospective Improve-axSpA project, clinical and imaging data from 969 patients evaluated at 63 centres were reviewed centrally through a telemedicine platform. Only 53.8% of patients with a local axSpA diagnosis were confirmed centrally, whereas in 33.7% an alternative cause of back pain—most commonly mechanical or degenerative—was considered more likely.[5] Such telemedicine-based expert review could provide a structured second opinion for diagnostically challenging cases and support multidisciplinary rheumatology–radiology collaboration.

Artificial intelligence and deep learning may extend this approach by detecting lesions, quantifying inflammation and structural damage, and applying standardized scoring systems at scale.[6] Their value is relevant to both clinical decision support and research. In our recent population-based study of 11,163 adults, expert assessment and a deep-learning algorithm both identified sacroiliac-joint bone marrow edema in approximately 30% of participants—far exceeding the prevalence of axSpA.[7] This illustrates both the power and the limitation of AI: algorithms can identify imaging abnormalities consistently, but they cannot make a disease-specific diagnosis without clinical and structural context.

Looking ahead, molecular imaging is likely to gain broader application in rheumatology. Positron emission tomography (PET)-based techniques use radiolabelled ligands, including monoclonal antibodies, to visualize specific cellular or molecular targets in vivo, rather than merely depicting anatomical changes or nonspecific tissue responses. Target-specific uptake could help distinguish immune-mediated inflammation from mechanically induced or degenerative lesions that appear similar on conventional MRI. Radiolabelled therapeutic antibodies could additionally map target expression before treatment and potentially support treatment selection.

Early studies using, for example, fibroblast activation protein-targeted PET/CT demonstrate the feasibility of visualizing biologically active lesions in axSpA, although fibroblast activation can also reflect tissue repair and remodelling.[8] Ultimately, combining anatomical, inflammatory, structural and molecular information may allow musculoskeletal imaging to progress from solely lesion detection towards biologically informed diagnosis and treatment selection.

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