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Axial involvement in psoriatic arthritis: An update for rheumatologists

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ABSTRACT

Psoriatic arthritis (PsA) is a heterogenous, chronic, inflammatory musculoskeletal disease that can lead to peripheral and axial damage and loss of function. Axial involvement occurs in 25% to 70% of patients with PsA, varying greatly depending on its definition, with the key manifestations being sacroiliitis and/or spondylitis. However, there are no agreed-upon classification or diagnostic criteria for axial involvement in PsA and no consensus on treatment paradigms, which complicates management of PsA. There have only been a few studies assessing biologics in patients with PsA with axial involvement, and most treatment plans are based on evidence from patients with axial spondyloarthritis. Rheumatologists therefore face many challenges in the management of axial PsA, including diagnosis, differential diagnosis, and choice of appropriate treatment. In this review, we summarize the clinical presentation, imaging characteristics, differential diagnoses, treatment options, and prognosis of axial PsA, with the aim of increasing rheumatologists' knowledge of this phenotype of PsA and thereby aiding its optimal management.

Introduction to axial psoriatic arthritis

Psoriatic arthritis (PsA), a chronic inflammatory disease, is characterized by nail and skin changes, peripheral arthritis, enthesitis, dactylitis, and axial disease, which can be present alone or in combination with each other [1-4]. Estimates of the global prevalence of PsA range widely from 0.05% to 0.25% in the general population, and it is estimated that up to 30% of patients with cutaneous psoriasis will develop PsA [5-7]. Furthermore, PsA is heterogenous in nature and can have an array of symptoms and effects, which poses a challenge in diagnosis and treatment [8,9].

Depending on the criteria used, 25% to 70% of patients with PsA may experience axial involvement, which is characterized by inflammation and postinflammatory structural changes of the spine and/or sacroiliac joints [10-12]. Only 2% to 5% of patients with PsA have exclusively axial involvement; most patients with axial disease as a manifestation of PsA also have peripheral arthritis [6,13-15]. Axial involvement has historically been thought to be more common in men than women [16-18], although recent studies have shown the prevalence to be similar [19,20]. A common feature of axial involvement is back pain that may have characteristics of inflammatory back pain. Inflammatory back pain—as a syndrome that is frequently present in patients with inflammatory affection of the axial skeleton but might also manifest in degenerative disorders—is characterized by insidious onset, morning stiffness in the back, improvement with exercise, no improvement with rest, and night pain, especially in the second half of the night [21-26].

The presence of HLA-B27 gene variants is associated with more severe PsA, and these variants are found more frequently in patients with axial involvement [15,27]. In addition, active inflammatory and structural changes in the axial skeleton (ie, typical active inflammatory and structural changes—sacroiliitis, spondylitis, syndesmophytes) can be detected by imaging (x-rays for structural changes and magnetic resonance imaging [MRI] for both active inflammatory

Abbreviations: AS, ankylosing spondylitis; ASAS, Assessment of SpondyloArthritis international Society; ASDAS, Ankylosing Spondylitis Disease Activity Score; axSpA, axial spondyloarthritis; BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; bDMARD, biologic disease-modifying antirheumatic drug; DISH, diffuse idiopathic skeletal hyperostosis; GRAPPA, Group for Research and Assessment of Psoriasis and Psoriatic Arthritis; IBD, inflammatory bowel disease; IL, interleukin; mBASDAI, modified Bath Ankylosing Spondylitis Disease Activity Index; MRI, magnetic resonance imaging; NSAID, nonsteroidal anti-inflammatory drug; PsA, psoriatic arthritis; SpA, spondyloarthritis; TNF, tumor necrosis factor; TNFi, tumor necrosis factor inhibitor

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and structural changes). Axial PsA is usually diagnosed based on clinical evaluation and imaging; efforts are underway by the Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA) and the Assessment of SpondyloArthritis international Society (ASAS) to define axial disease in PsA in the AXIS (Axial Involvement in Psoriatic Arthritis Cohort; NCT04434885) study [28-30].

Axial involvement in PsA was first described in 1961 with the observation of frequent sacroiliac erosion, sclerosis, and ankylosis in patients with PsA that were not present in control patients with rheumatoid arthritis [31]. Although axial involvement in PsA was described > 50 years ago, treatment recommendations until recently were mostly derived from evidence in patients with ankylosing spondylitis (AS) or axial spondyloarthritis (axSpA) [32]. Given the similar clinical and imaging presentations of axial PsA and axSpA, axSpA treatment recommendations were at one time a useful guide for the treatment of PsA with axial involvement but did not consider unique features presented in axial PsA, demonstrating the need for axial PsA-specific treatment guidelines. However, characterization of axial PsA remains poorly understood due to limited data available on this specific patient population, and no consensus exists on how to define or screen for axial disease, which poses a potential challenge for rheumatologists in managing this form of PsA (**Table 1**) [12,18,30,33].

Statement of literature search

The following search strings were used to identify articles by a series of PubMed and congress searches covering publications through April 30, 2021 (**Fig. 1**): ("psoriatic arthritis" OR PsA) AND ("axial disease" OR sacroiliitis OR "inflammatory back pain" OR IBP), and ("axial psoriatic arthritis" OR "axial PsA" OR "axPsA"). Publications mentioning clinical presentations, imaging characteristics, differential diagnosis, treatment options, and prognosis of axial PsA were included based on the judgment of authors. Publications cited within included articles and those previously known to the authors were also considered based on the criteria described.

Clinical presentations of axial PsA

Typical symptoms of axial PsA include back pain that can occur in any part of the spine. Back pain might have inflammatory characteristics as described earlier. In some cases, axial involvement in PsA can be clinically asymptomatic despite inflammation in the axial skeleton.

In a descriptive analysis of patients with PsA in the Corrona Psoriatic Arthritis/Spondyloarthritis Registry, patients with axial involvement were younger (50.4 vs 54.4 years; $P < 0.001$) and had worse clinical and patient-reported outcomes compared with patients

Table 1
Variations for classification of axial PsA in studies.

Study	Classification
MAXIMIZE[34,35] Secukinumab clinical trial of 498 patients with axial PsA with inadequate response to NSAIDs	Diagnosis of PsA classified by CASPAR criteria, BASDAI ≥ 4, and spinal pain VAS ≥ 40
DISCOVER-1 and −2[36] Post hoc exploratory analysis of guselkumab clinical trials of 381 patients with active PsA in DISCOVER-1 and 739 in DISCOVER-2	Active PsA (DISCOVER-1: ≥ 3 swollen joints, ≥ 3 tender joints, CRP ≥ 0.3 mg/dL despite standard therapies; DISCOVER-2: ≥ 5 swollen joints, ≥ 5 tender joints, CRP ≥ 0.6 mg/dL despite standard therapies) with current or past sacroiliitis on imaging as judged by local investigator
Axial disease in psoriatic arthritis study[37] Single-center study of 201 patients with PsA and 201 patients with AS	Diagnosis of PsA classified by CASPAR criteria, diagnosis of psoriasis (past/present), and radiographic sacroiliitis (as per modified New York criteria for AS)
Aydin et al[18] Registry study of 1186 patients with PsA (PsART)	Presence of inflammatory back pain; no specific imaging requirements
Mease et al[19] Registry study of 1530 patients with PsA (Corrona PsA/SpA Registry)	Presence of spinal involvement based on clinical features thought to be representative of active inflammatory spondylitis and/or radiographs or MRI showing sacroiliitis
Ogdie et al[38] Registry study of 3393 patients with PsA (Corrona PsA/SpA Registry)	Investigator defined based on clinical assessment, imaging, and laboratory workup
Ibrahim et al[39] Radiographs from 105 patients with axial PsA (University of Toronto PsA clinic)	Diagnosis of PsA classified by CASPAR and axial PsA, defined as grade ≥ 2 unilateral sacroiliitis and inflammatory back pain or restricted spine mobility
Chandran et al[15] Single-center study of 50 patients with axial PsA (University of Toronto PsA clinic)	Diagnosis of psoriasis, grade ≥ 2 bilateral sacroiliitis or grade ≥ 3 unilateral sacroiliitis
Yap et al[40] Single-center study of 171 patients with PsA (University of Toronto PsA clinic)	Diagnosis if PsA classified by CASPAR, electronically determined if patient satisfied each criteria set for inflammatory back pain (Calin, Rudwaleit, and ASAS criteria for inflammatory back pain), have axial radiographic abnormalities with and without back pain, including grade ≥ 2 unilateral sacroiliitis or syndesmophytes
Feld et al[11] Retrospective analysis of a prospective cohort of 1354 patients with PsA (University of Toronto PsA clinic)	Defined axial PsA as the highest sacroiliitis grade scored across radiographs available per patient; assessed 3 definitions of sacroiliitis: 1. unilateral grade ≥ 2 sacroiliitis, 2. the mNY AS radiographic criteria: bilateral grade ≥ 2 sacroiliitis or unilateral grade 3 or 4, and 3. the mNY AS radiographic and clinical arm criteria: back pain or limitation of lumbar spine in sagittal and frontal planes or limitation of chest expansion; spinal limitation was defined as Schober ≤ 4 cm, lateral flexion ≤ 10 cm, or chest expansion < 5 cm
Haroon et al[41] Single-center study of 407 patients with PsA	Presence of bone marrow edema on MRI of sacroiliac joints, inflammatory back pain according to the ASAS definition, with spinal pain score ≥ 4 and BASDAI ≥ 4 despite taking NSAIDs
Fernandez-Sueiro et al[42] Single-center study of 54 patients with peripheral PsA and 46 patients with axial PsA	Diagnosis of PsA classified by CASPAR and axial PsA defined as grade ≥ 2 unilateral sacroiliitis and inflammatory back pain and back stiffness
Queiro and Cañete[43] Medical records of 70 patients with psoriasis and radiographic signs of SpA	Defined by the ASAS classification criteria for axSpA

AS, ankylosing spondylitis; ASAS, Assessment of SpondyloArthritis international Society; axSpA, axial spondyloarthritis; BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; CASPAR, Classification of Psoriatic Arthritis; CRP, C-reactive protein; MRI, magnetic resonance imaging; NSAID, nonsteroidal anti-inflammatory drug; PsA, psoriatic arthritis; PsART, Psoriatic Arthritis of Turkey; SpA, spondyloarthritis; VAS, visual analog scale.

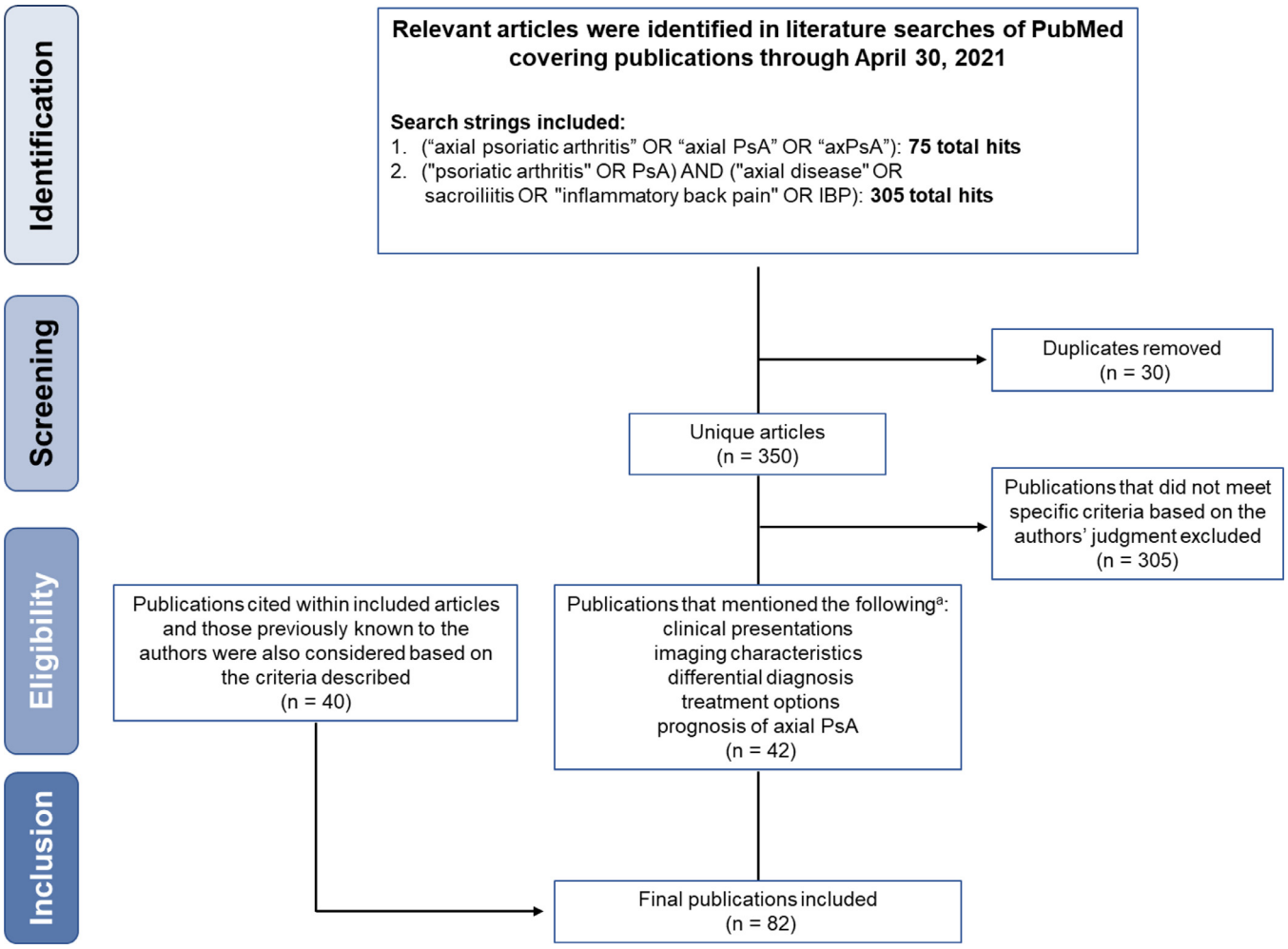

Fig. 1. Literature search methodology.
axPsA, axial PsA; IBP, inflammatory back pain; PsA, psoriatic arthritis.

without axial involvement, with a greater impact on work productivity and social and mental aspects of quality of life [19]. Furthermore, these patients may have more severe skin manifestations, more severe joint disease, more enthesitis, and worse disease activity compared with patients without axial involvement [19]. PsA mutilans is more likely to occur in patients with radiographic evidence of structural damage in the axial skeleton [44]. In a retrospective follow-up study from the Corrona Psoriatic Arthritis/Spondyloarthritis Registry looking at 2 different definitions of axial disease, patients with investigator-defined axial PsA had more coexisting manifestations of PsA, with the most common being peripheral arthritis along with skin disease [38]. Risk factors for developing axial involvement in PsA are HLA-B27 positivity, presence of radiographic peripheral joint damage, and increased erythrocyte sedimentation rate [15].

Common extramusculoskeletal features besides psoriasis that are associated with axial PsA and axSpA with HLA-B27 positivity are uveitis and inflammatory bowel disease (IBD) [45,46]. Both uveitis and IBD are more frequent in patients with axial PsA compared with patients with no axial involvement, which is consistent with a more SpA-like phenotype.

Numerous genetic susceptibility loci have been identified for PsA and axSpA; however, HLA-B27 is an important allele variant that has been identified in both [47]. Further studies have shown that HLA-B27 is a key risk factor for axial Ps [19,37].; patients with axial PsA are more likely to be HLA-B27 positive than patients without axial involvement (43.7% vs 19.1%) [19]. Although HLA-B27 positivity is not as common in axial PsA compared with axSpA, this marker is associated with poorer prognosis and more severe radiographic changes in patients with axial PsA [47]. However, other HLA loci, including HLA-B08 and HLA-B38, have been linked to axial disease in patients with PsA [48]. Specifically, asymmetrical and less severe radiographic sacroiliitis has been associated with HLA-B08 [49].

Imaging characteristics

Radiographic sacroiliitis is a common feature of axial PsA, occurring in 25% to 50% of patients with PsA, and is frequently asymmetrical (in 73% of patients) [49-52]. In one study of patients with PsA, radiographic sacroiliitis was significantly associated with younger age of PsA onset ($P \leq 0.001$), peripheral joint erosions ($P = 0.043$), maximum Psoriasis Area and Severity Index score ($P = 0.041$), and presence of HLA-B*0801 ($P = 0.002$) [49]. Patients with asymmetrical sacroiliitis were more likely to be female ($P = 0.04$), have more osteolysis ($P = 0.01$), show a trend for more severe nail psoriasis and joint erosions ($P = 0.08$), have HLA-B*0801 positivity ($P = 0.001$), and not have HLA-B*270,502 positivity ($P \leq 0.001$) [49].

Typical structural changes in the spine include asymmetrical coarse thorn-like nonmarginal syndesmophytes (although typical syndesmophytes might also occur), and in some cases, early affection of cervical spine, including fusion of facet joints, which may occur in the absence of sacroiliitis or relevant involvement of other parts of the spine [29,53].

MRI can also detect structural changes associated with axial PsA as well as active inflammatory changes indicative of early stages of

disease [54,55]. For instance, bone marrow and soft tissue edema can be observed on MRI in the sacroiliac joints and joint capsules and ligaments, as well as in the spine with involvement of vertebral bodies (eg, spondylitis, inflammatory discovertebral lesions); facet, costovertebral, and costotransverse joints; and entheses [54,56].

Differentiating axial PsA from axSpA and diffuse idiopathic skeletal hyperostosis

Although it may be difficult, or even impossible in some cases, to distinguish between axial PsA and primary axSpA due to overlapping features, axial PsA can have distinct clinical presentations, genetic factors, radiographic characteristics, and possibly response to treatmen [57,58]. (**Fig. 2**).

Only 45% of patients with radiographic axial PsA have inflammatory back pain, while some patients may be clinically perceived as asymptomatic[40,41,52,59]; however, it is possible that the proportion of patients with radiographic axial PsA without inflammatory back pain is overestimated due to interreader variability in evaluation of lower-grade sacroiliitis. In cross-sectional studies, patients with axial PsA had a higher frequency of dactylitis, enthesitis, and peripheral arthritis; had more damaged joints; and were more likely to have peripheral disease than patients with axSpA [60-64]. These observations were consistent in a study comparing patients with axial PsA to patients with AS and psoriasis [65].

Although HLA-B27 positivity can be present in both patients with axSpA and axial PsA, this is the only identified common risk factor; in addition, axial PsA is more frequently associated with other HLA loci than HLA-B27, such as HLA-B08 [48,59]. HLA-B08 was found to be associated with less severe radiographic sacroiliitis and asymmetry in axial PsA [49,66]. There is more frequently isolated spinal involvement without affection of sacroiliac joints and more frequent involvement of the cervical spine in patients with axial PsA compared with patients with axSpA [37,62,65,67-70]; a higher frequency of nonmarginal syndesmophytes and proportionally fewer marginal slim bridging syndesmophytes are observed in patients with axial PsA compared with axSpA [67]. Therefore, patients with axial PsA or axSpA may require slightly adapted diagnostic and classification approaches.

It may also be challenging to differentiate axial PsA from diffuse idiopathic skeletal hyperostosis (DISH) because the coarse nonmarginal syndesmophytes characteristic of axial PsA can appear similar to the paravertebral osteophytes found in DISH on radiographs [29,71,72]. DISH frequently develops without sacroiliitis or low back pain [72]. which can complicate differentiation between DISH and asymptomatic axial PsA or axial PsA without sacroiliitis. However, in patients with PsA, axial PsA is associated with younger age and a higher prevalence of HLA-B27, whereas DISH is associated with older age and higher body mass index and is not associated with HLA-B27 [19,72,73]. Additionally, peripheral enthesopathy in DISH is characterized by bony spurs at the entheses visible on radiographs and no or only slightly inflammatory reactions compared with enthesitis in PsA [71]. In contrast to axial PsA, there is currently no evidence supporting the effectiveness of nonsteroidal anti-inflammatory drugs (NSAIDs), biologic disease-modifying antirheumatic drugs (bDMARDs), or physiotherapy for the management of DISH [72]. Thus, distinguishing between DISH and axial PsA is important to ensure proper treatment.

Treatment options for axial PsA

The pathogenesis of axial PsA is not well understood; however, there is evidence that the interleukin (IL)−23/17 pathway is an important driver of inflammation. IL-23 influences the expression of IL-17, IL-22, and tumor necrosis factor α (TNF-α) from T helper 17 cells, leading to inflammation, tissue lesions, bone remodeling, and production of other cytokines [74]. Entheseal inflammation is an important feature contributing to axial arthritis, as opposed to the

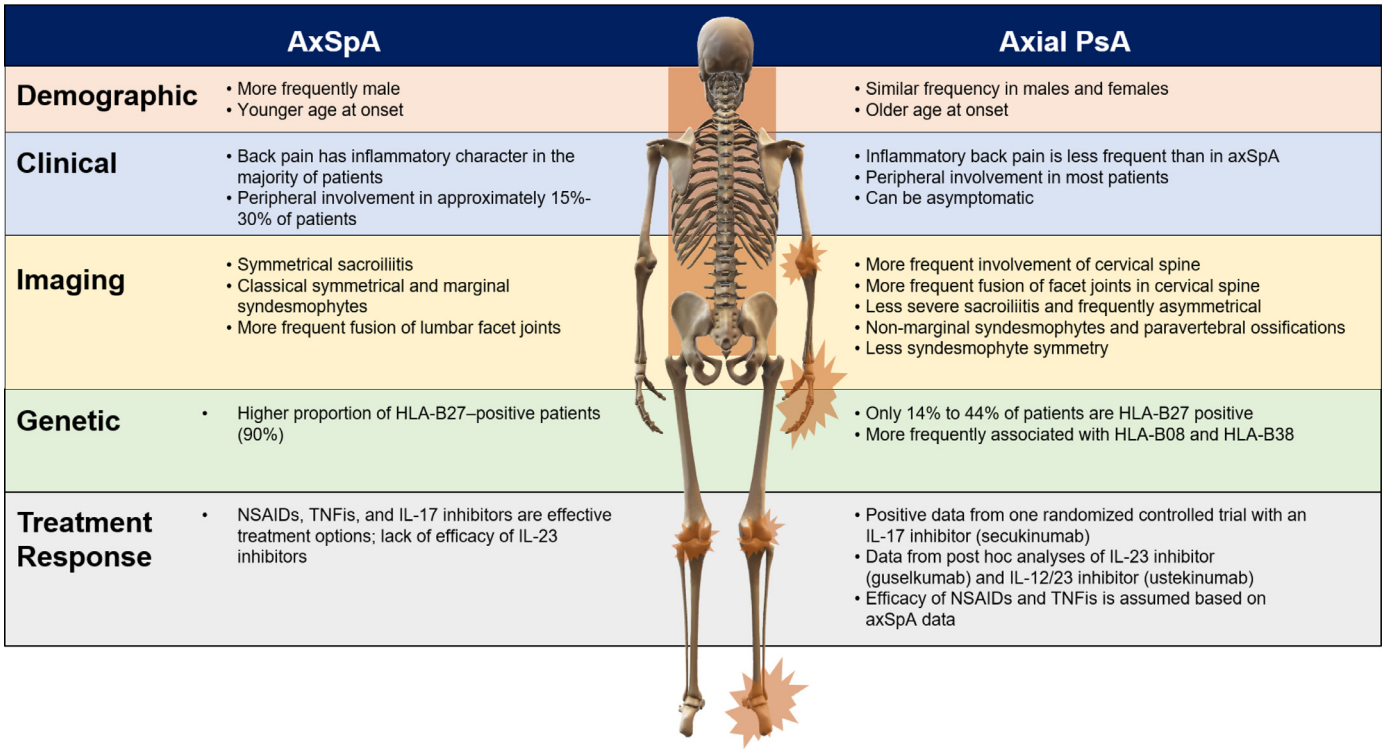

Fig. 2. Differences in clinical, genetic, and radiographic features and treatment responses between axial PsA and axSpA
axSpA, axial spondyloarthritis; IL, interleukin; NSAID, nonsteroidal anti-inflammatory drug; TNFi, tumor necrosis factor inhibitor.

synovitis that occurs more often in rheumatoid arthritis, and is driven by activation of T cells present in the entheses. Targeting the TNF-α and IL-17 pathways represents the current principal strategy for therapeutic intervention with bDMARDs. Additionally, Janus kinase inhibition is an emerging treatment approach.

If symptoms of axial PsA are not controlled by NSAIDs, which historically represent the first-line treatment in this patient population, guidelines developed by GRAPPA, the European League Against Rheumatism, and the American College of Rheumatology and National Psoriasis Foundation recommend initiation of bDMARDs [32,75-77]. Current practice is often to use TNF inhibitors (TNFis); however, IL-17A inhibitors are preferred over TNFis in the presence of significant skin involvement [76]. Drugs targeting the IL-12/23 pathway are not, at the present time, indicated for patients with predominantly axial disease due to a lack of clear efficacy in axSpA [76]. Currently, there are no data from randomized controlled studies in axial PsA supporting the efficacy of TNFis in this patient population. However, TNFis have been shown to be effective in patients with radiographic axSpA and nonradiographic axSpA. Adalimumab, certolizumab pegol, golimumab, and infliximab are recommended in the United States over etanercept for patients with axSpA who have IBD or recurrent uveitis (no evidence for golimumab) because etanercept has contradictory results for uveitis and no efficacy in IBD [78].

Studies have demonstrated that IL-17A inhibitors are effective and safe in the treatment of axSpA, and there is currently only 1 randomized controlled study (MAXIMIZE) that has attempted to address the axial PsA population directly. In the MAXIMIZE study of patients with axial PsA—that was defined based on clinical judgment of the investigator and Bath Ankylosing Spondylitis Disease Activity Score (BASDAI) of $>$ 4—who had inadequate response to NSAIDs, 63.1% and 66.3% receiving secukinumab 300 mg and 150 mg, respectively, achieved ASAS20 responses at week 12 compared with 31.3% receiving placebo; reductions of Berlin MRI scores evaluating bone marrow edema for entire spine and sacroiliac joints were statistically significant at week 12 ($P < 0.01$) [34]. Response was maintained through week 52, at which 75.0% and 79.7% of patients receiving secukinumab 300 mg and 150 mg, respectively, achieved ASAS20 [35]. Reductions in total Berlin MRI score for the entire spine and sacroiliac joints were maintained through week 52, with similar improvements seen in those initially randomized to placebo who switched to secukinumab at week 12 [35]. No objective confirmation of axial disease was required, and approximately 60% of the patients had active inflammatory lesions in the MRIs defined by bone marrow edema for the sacroiliac joints and spine.

Although bDMARDs targeting the IL-12/23 pathway did not demonstrate efficacy in the treatment of primary axSpA [79,80]. recent studies have suggested that IL-23 inhibitors may be effective for the treatment of axial symptoms in patients with PsA. In an exploratory post hoc analysis of the phase 3 DISCOVER-1 and DISCOVER-2 trials, patients with PsA with imaging-confirmed sacroiliitis (according to the local clinician's judgment on radiography and/or MRI) receiving guselkumab had improvements in BASDAI, spinal pain, modified BASDAI (mBASDAI; BASDAI excluding peripheral arthritis), and Ankylosing Spondylitis Disease Activity Score (ASDAS) using C-reactive protein compared with placebo at week 24 [36]. Furthermore, compared with patients receiving placebo, a higher proportion of patients receiving guselkumab 100 mg every 8 weeks or every 4 weeks achieved BASDAI50 (40.5% or 37.9%, respectively, vs 19.1%) and ASDAS responses of inactive disease (17.4% or 10.0% vs 1.7%), major improvement (27.9% or 30.0% vs 8.7%), and clinically important improvement (53.5% or 57.0% vs 28.7%; $P < 0.05$ for all) at week 24. The presence of sacroiliitis on imaging was not confirmed by central evaluation, and no follow-up imaging of the axial skeleton was conducted. Thus, these data require confirmation in a prospective controlled study focusing on axial involvement in PsA.

More recently, a post hoc analysis of the pooled PSUMMIT-1 and PSUMMIT-2 studies demonstrated that TNFi-naive patients with PsA and physician-reported axial involvement (originally worded as "spondylitis") receiving ustekinumab had improvements in BASDAI neck/pain/hip pain and mBASDAI than those receiving placebo, which may be partially attributed to improvements in peripheral arthritis; the mBASDAI removes question 3, which addresses peripheral arthritis, so it may not be specific for axial disease in people who have peripheral arthritis [81]. No imaging outcomes were included in this analysis. These results may suggest the possibility of differential treatment responses between patients with axSpA and axial PsA through potentially distinct immunopathogeneses, a prospect that needs more thorough study, and a need for axial PsA-specific measures to evaluate clinical, imaging, and immunophenotypic outcomes [41].

A study evaluating targeted synthetic DMARDs for the treatment of axial PsA is ongoing; the PASTOR (NCT04062695) study of patients with axial PsA will evaluate the efficacy of tofacitinib in reducing inflammation in the sacroiliac joints and in the spine on MRI. In a phase 2 study of patients with active AS, tofacitinib demonstrated greater clinical efficacy in reducing the signs, symptoms, and objective endpoints (including MRI of sacroiliac joints and spine) compared with placebo at week 12 [82].

Conventional synthetic DMARDs (eg, methotrexate) and systemic steroids are not recommended in axial PsA based on limited data from axSpA studies; there are no studies using these treatment modalities in axial PsA [32,76,77].

Prognosis of axial PsA: clinical challenges for rheumatologists

Concerns of diagnosis of axial PsA arise due to the lack of defining features of the disease, including spinal involvement without sacroiliitis, delayed appearance of radiographic sacroiliitis, and possible low level of symptoms indicative of spinal involvement [83]. Since the risk of degenerative spinal lesions increases with age, imaging changes consistent with axial PsA will more likely be confounded by the presence of degenerative imaging changes that are being deeply investigated as simply aging [59,84,85]. Increased age also complicates the evaluation of radiographs in patients with axial PsA due to the possible presence of degenerative arthritis or diffuse idiopathic skeletal hyperostosis [73,86]. Furthermore, the presence of inflammatory back pain does not necessarily indicate the presence of inflammation, and inflammatory back pain may be present as a manifestation of a mechanical back issue, such as intervertebral disk degeneration [87]. which may be the sole reason for pain and which can occur concomitantly with axial PsA. Fibromyalgia, a subset of the condition of central sensitization, is a comorbidity of any rheumatic disease, and although estimates vary, fibromyalgia/central sensitization occurs in 15% to 36% of patients with PsA. When present, fibromyalgia/central sensitization leads to elevation of subjective components of disease activity measures, including spine pain, confounding evaluation of axial disease and falsely indicating an inability to achieve remission or low disease activity of the primary disease, PsA or axial PsA, even with effective therapy [88,89]. Treatment can be complicated by the presence of comorbidities (eg, cardiovascular disease and metabolic disease) and extramusculoskeletal manifestations (eg, IBD and uveitis), which may have a greater impact on overall morbidity and mortality compared with no comorbidities; therefore, comorbidities need to be properly managed and monitored during the long-term treatment of axial PsA [45].

There are limited data on the monitoring of the longitudinal progression of structural damage in axial PsA; furthermore, the scoring assessments available are designed for patients with axSpA, and they assess sacroiliitis and vertebral changes and do not allow for differentiation of SpA features [39]. Defining radiographic and MRI features of axial PsA (ie, involvement of posterior/lateral vertebral structures) is

imperative for distinguishing the disease from other forms of SpA [39].

Although the ASDAS and BASDAI have been used to assess axial disease activity [43,90]. these measures were developed for axSpA, and their psychological properties have not been evaluated in axial PsA. As a cautionary recommendation, physicians should use more than the BASDAI alone to diagnose axial PsA but may use BASDAI to monitor axial PsA. While BASDAI significantly correlates with patient's perception of disease activity (r = 0.739), it does not correlate with the pattern of disease (ie, axial or peripheral) or with physician's perception of disease activity and treatment decisions, especially since there is only 1 question that asks about joint pain other than spine pain, which may be the main driver of the scores reported in patients with PsA [91]. Furthermore, no association has been observed between changes in BASDAI and changes in disease activity for both peripheral and axial PsA assessed by BASDAI, suggesting that BASDAI is not a valid instrument for evaluating disease activity in axial PsA [42]. Some approaches to improve specificity for axial PsA spine assessment have included using question 2 of the BASDAI, which is specific for spine, buttock, and hip pain; a separate spine pain visual analog scale question; and/or assessment of a cohort of patients with PsA with imaging consistent with axial PsA at baseline.

Conclusions

Highlighting the clinical characteristics, diagnostic tests, imaging characteristics, and prognosis of axial PsA provides rheumatologists with a better understanding of the disease and potential to identify axial PsA earlier. ASAS and GRAPPA are collaborating on the AXIS study to develop classification criteria for axial PsA; the results of the study are eagerly awaited. However, further studies are needed to evaluate treatment of the axial PsA patient population to identify effective therapeutic strategies.

Author contributions

D. Poddubnyy, D.R. Jadon, F. Van den Bosch, P.J. Mease, and D.D. Gladman meet the International Committee of Medical Journal Editors (ICMJE) criteria for authorship for this article, were responsible for the conceptualization and strategy of the review and for reviewing and revising all drafts, take responsibility for the integrity of the work as a whole, and have given their approval for this version to be published.

Declarations of Interest

D. Poddubnyy has received research grants from AbbVie, Eli Lilly, MSD, Novartis, and Pfizer and has received consultancy or speaker fees from AbbVie, Biocad, Bristol Myers Squibb, Eli Lilly, Gilead, GlaxoSmithKline, Janssen, MSD, Novartis, Pfizer, Samsung Bioepis, and UCB. D.R. Jadon has received research grants from Pfizer, Eli Lilly, Merck, GSK, Biogen, and Celgene and has received educational grants from Novartis, Eli Lilly, Biogen, Gilead, Pfizer, UCB, AbbVie, Janssen, Amgen, Bristol Myers Squibb, Roche, and Celltrion; his research time was also partially funded by the Cambridge Arthritis Research Endeavour. F. Van den Bosch has received consultancy and/or speaker fees from AbbVie, Celgene, Eli Lilly, Galapagos, Gilead, GSK, Janssen, Novartis, Pfizer, and UCB. P.J. Mease has received research grants from Celgene, Novartis, AbbVie, Amgen, Bristol Myers Squibb, Gilead, Eli Lilly, Pfizer, Sun Pharma, and UCB; consulting fees from Celgene, Corrona, Novartis, AbbVie, Amgen, Boehringer Ingelheim, Bristol Myers Squibb, Galapagos, Gilead, GSK, Janssen, Eli Lilly, Merck, Pfizer, Sun Pharma, and UCB; and speakers bureau fees from AbbVie, Amgen, Janssen, Novartis, Pfizer, and UCB. D.D. Gladman has received research grants from AbbVie, Amgen, Celgene, Eli Lilly, Novartis, Pfizer, and UCB and consulting fees from AbbVie, Amgen, Bristol Myers Squibb, Celgene, Galapagos, Gilead, Janssen, Lilly, Novartis, Pfizer, and UCB.

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