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Axial Spondyloarthritis in Athletes: A Narrative Review of Diagnostic Challenges and Quality of Medical Management

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ABSTRACT

Background. Axial spondyloarthritis (axSpA) is a chronic inflammatory disease affecting the spine and sacroiliac joints. In athletes, clinical identification is difficult due to symptomatic overlap with mechanical overuse and specific behavioral patterns of professional competitors.

Aim. This review evaluates diagnostic hurdles of axSpA in athletes and analyzes medical management quality based on evidence from 2021–2026.

Material and methods. Following SANRA guidelines, a systematic search of PubMed and Google Scholar was performed, focusing on peer-reviewed literature at the intersection of inflammatory diseases and sports medicine.

Results. The athletic culture of enduring pain contributes to a diagnostic delay often exceeding seven years. Professional athletes frequently present with exercise-induced bone marrow edema on MRI, which can mimic active sacroiliitis. Effective management requires a multidisciplinary approach integrating modern pharmacotherapy with specialized physiotherapy, adhering to 2022 ASAS-EULAR recommendations and WADA regulations.

Conclusions. A research gap exists regarding prospective studies in elite athletes. Improving care quality necessitates specialized screening protocols to differentiate physiological adaptations from systemic inflammation, ensuring career longevity and high quality of life.

Keywords: axial spondyloarthritis; sports medicine; diagnostic delay; bone marrow edema; quality of medical management; magnetic resonance imaging; therapeutic use exemptions

1. Introduction

Axial spondyloarthritis represents a significant spectrum of chronic immune-mediated pathologies that primarily involve the axial skeleton. The condition is formally categorized into radiographic and non-radiographic forms, depending on the presence of structural damage visible on conventional X-rays [1]. In the specific context of sports medicine, axSpA presents a profound diagnostic paradox. While physical activity is a vital component of the therapeutic strategy, the extreme mechanical loads characteristic of high-performance training often mask the early indicators of systemic inflammation [2]. Recent evidence highlights that the quality of diagnostic pathways remains suboptimal, as many patients encounter a delay of approximately seven years before receiving an accurate diagnosis [3].

The phenomenon of diagnostic delay is particularly pronounced in the athletic community, where high pain tolerance and the regular use of anti-inflammatory medications are common. Systematic reviews and meta-analyses indicate that this delay is influenced by a complex interplay of geographic, sociodemographic, and disease-related factors [4, 5]. Furthermore, research suggests a notable sex bias in the recognition of the disease, as women often face even

longer periods of clinical uncertainty before a correct diagnosis is established [6]. For athletes, the failure to distinguish between inflammatory back pain and mechanical strain can lead to irreversible structural damage and the premature termination of a professional career [7]. This review evaluates the necessity of improving medical management quality by integrating advanced imaging, laboratory markers, and interdisciplinary collaboration within the framework of current rheumatological guidelines.

2. Material and methods

The preparation of this narrative review followed the Scale for the Assessment of Narrative Review Articles (SANRA) guidelines to ensure methodological rigor and structural transparency. A comprehensive literature search was conducted across the PubMed and Google Scholar databases, covering publications from January 2021 to April 2026. The search strategy utilized targeted keywords, including axial spondyloarthritis, sports medicine, athletic performance, and diagnostic delay. Inclusion criteria were strictly limited to peer-reviewed original research, systematic reviews, and meta-analyses that addressed the intersection of inflammatory spinal diseases and physical exertion. Exclusion criteria comprised editorials, conference abstracts, case reports, and studies published prior to January 2021 or addressing non-athletic populations without direct clinical implications for the management of inflammatory spinal disease in physical exertion contexts. This approach prioritized evidence-based data regarding the differentiation of systemic inflammation from mechanical strain in high-performance environments [4, 5].

3. The Diagnostic Dilemma in Athletes: Overlap and Barriers

The clinical identification of axial spondyloarthritis in athletes is profoundly complicated by the prevailing culture of sports medicine, where enduring physical pain is often normalized and even rewarded. Professional competitors frequently misinterpret early symptoms of systemic inflammation as routine results of intensive training or minor mechanical injuries [8]. This behavioral pattern leads to a significant reliance on routine self-medication with non-steroidal anti-inflammatory drugs (NSAIDs). While NSAIDs are the first-line treatment for axSpA, their frequent administration in sports effectively masks the inflammatory nature of the disease, thereby suppressing clinical symptoms and laboratory markers of inflammation [9, 10].

Furthermore, the diagnostic overlap between inflammatory back pain and mechanical strain represents a major hurdle for medical professionals. Features typically associated with axSpA, such as improvement of symptoms with exercise and the presence of morning stiffness, are

often erroneously attributed to a thorough warm-up or physiological post-exercise recovery [8, 11]. Unlike the general population, athletes often present with a mixed clinical picture where the insidious onset of systemic inflammation is overshadowed by the acute nature of sports-related trauma. To optimize the quality of medical management, it is essential to implement screening tools that specifically account for the unique physiological and psychological environment of the elite athlete, moving beyond traditional classification criteria that may lack specificity in this population [12].

4. Advanced Imaging: The Paradox of Bone Marrow Edema in Athletes

The utilization of magnetic resonance imaging (MRI) has revolutionized the detection of early inflammatory changes in axial spondyloarthritis, yet its application in the athletic population introduces significant diagnostic pitfalls. An "ASAS-positive MRI" requires the presence of subchondral bone marrow edema (BME) in at least two consecutive slices or at two different locations within the sacroiliac joints [13]. However, the diagnostic quality is often compromised by exercise-induced BME, which can mimic active sacroiliitis. Clinical evidence suggests that intensive mechanical loading during high-performance training leads to physiological remodeling of the bone, resulting in BME patterns that should be considered "innocent until proven guilty" [14].

Recent studies emphasize the importance of differentiating these mechanical adaptations from true autoimmune inflammation by analyzing the topographical location of the lesions. In athletes, BME is frequently localized at the sites of maximal mechanical stress, whereas early axSpA lesions tend to cluster in specific anatomical regions of the sacroiliac joint, such as the posterior and lower segments [15]. Furthermore, diagnostic errors are often driven by a lack of specificity in reading MRI scans, as BME is not pathognomonic for spondyloarthritis and can be found in a significant percentage of asymptomatic active individuals [16, 17]. To enhance the quality of medical management, radiologists and sports medicine specialists must account for radiological "mimics" such as stress fractures or degenerative changes, integrating MRI findings with the clinical "sport culture" context to avoid overdiagnosis [18].

5. Laboratory Biomarkers and Genetic Factors: Interpretative Challenges

The laboratory assessment of axial spondyloarthritis in the athletic population requires a precise interpretation of systemic inflammatory markers and genetic predispositions. The presence of the HLA-B27 antigen remains a cornerstone of the diagnostic framework, as it significantly increases the pre-test probability of axSpA in patients presenting with chronic back pain [19].

Recent clinical insights emphasize that while this marker is essential, its absence does not fully exclude the disease; HLA-B27-negative axial spondyloarthritis represents a distinct clinical subgroup that often experiences even longer diagnostic delays [20]. For sports medicine specialists, identifying the HLA-B27 status is a high-quality screening step that aids in the early referral of at-risk individuals to specialized rheumatological care [21].

Furthermore, the utility of traditional inflammatory markers such as C-reactive protein (CRP) is frequently limited in high-performance athletes. Intensive physical exertion can cause transient elevations in CRP levels due to exercise-induced muscle tissue microtrauma, which may be misinterpreted as a sign of active systemic inflammation. Conversely, a significant portion of patients with non-radiographic axial spondyloarthritis may present with completely normal CRP levels despite active disease as seen on MRI [3]. This lack of laboratory sensitivity highlights the need for a comprehensive diagnostic approach where genetic testing for HLA-B27 is integrated with clinical history and advanced imaging to ensure accurate management. The effectiveness of established biological treatments, particularly TNF inhibitors, is also closely linked to the HLA-B27 status, making early genetic screening a vital component of the "treat-to-target" strategy [22].

6. Pharmacotherapy and Management Strategies: The Shift Toward Treat-to-Target

The modern management of axial spondyloarthritis has been fundamentally reshaped by the 2022 ASAS-EULAR recommendations, which advocate for a personalized and multidisciplinary approach [23]. For athletes, the primary goal of pharmacotherapy is to achieve sustained remission or low disease activity to prevent structural damage and maintain high functional capacity. While non-steroidal anti-inflammatory drugs (NSAIDs) remain the first-line therapy, their long-term use in professional sports requires careful monitoring due to potential gastrointestinal and cardiovascular side effects [24]. In cases where NSAIDs provide insufficient relief, the introduction of biological disease-modifying antirheumatic drugs (bDMARDs), such as TNF inhibitors or IL-17 inhibitors, is recommended to control systemic inflammation effectively [23].

Janus kinase (JAK) inhibitors, particularly upadacitinib, represent a notable addition to the therapeutic armamentarium for axSpA. Clinical evidence from the SELECT-AXIS 2 trial demonstrates that JAK inhibitors provide rapid and significant improvement in both radiographic and non-radiographic forms of the disease [25, 26]. Despite their efficacy, the use of JAK inhibitors in athletes necessitates a thorough benefit-risk assessment, particularly regarding the potential risk of thromboembolic events and their impact on intensive training

regimens [27, 28]. The quality of management is operationalized through the “treat-to-target” strategy, where regular monitoring of disease activity using validated tools allows for timely adjustments in medication [29]. This proactive approach is essential for athletes to ensure that the disease continuum does not progress to irreversible spinal fusion, thereby safeguarding both health and professional longevity.

7. Physiotherapy and Rehabilitation: The Non-Pharmacological Pillar

Non-pharmacological intervention remains a mandatory component of axial spondyloarthritis management, particularly for athletes whose careers depend on spinal mobility and functional capacity. The 2022 ASAS-EULAR recommendations explicitly elevated structured exercise therapy from an adjunctive measure to a cornerstone of axSpA management, placing it on equal footing with pharmacological treatment for the first time [23]. This paradigm shift is especially significant in the athletic context, where movement-based interventions can be seamlessly integrated into existing training routines.

Recent systematic reviews and meta-analyses from 2024 and 2025 confirm that structured exercise therapy significantly reduces disease activity scores, including BASDAI and ASDAS, and improves functional outcomes measured by BASFI and BASMI [30]. A comprehensive meta-analysis and meta-regression of randomized controlled trials by Zhang et al. (2025) demonstrated that aerobic, flexibility, and strength-based programs each independently contributed to reductions in spinal inflammation and improvements in cardiopulmonary function, with the greatest gains observed in programs combining all three modalities [30]. These findings are directly applicable to the athletic population, where cross-disciplinary training is already standard practice.

The integration of various exercise modalities has proven superior to sedentary management in alleviating the hallmark symptoms of axSpA. Boudjani et al. (2023), in a systematic review and meta-analysis of controlled trials, demonstrated that programs combining flexibility and muscle strength exercises produced the largest effects on spinal mobility, while aerobic-inclusive programs were particularly effective for functional improvement [31]. For competitive athletes, aquatic-based physiotherapy deserves particular attention, as it simultaneously reduces mechanical joint load while maintaining cardiovascular conditioning — a critical consideration during active disease flares. Physiotherapy protocols must be highly individualized to account for the specific mechanical demands of the athlete's discipline, ensuring that therapeutic exercises do not exacerbate existing joint microtrauma [32].

Furthermore, maintaining a high level of physical activity is directly correlated with better health status and compliance with global WHO recommendations among axSpA patients. A prospective study by Carbo et al. (2025) confirmed that patients who met recommended weekly physical activity targets reported significantly better quality of life scores and lower disease activity compared to sedentary counterparts [33]. These findings reinforce the therapeutic value of the athlete's pre-existing commitment to movement. However, patient awareness and education regarding the distinction between therapeutic exercise and harmful overloading are essential for long-term adherence to rehabilitation programs [34]. Athletes, paradoxically, may be more prone to exceeding safe exercise thresholds, which can trigger post-exertional inflammation and confound disease monitoring.

Network meta-analyses have further refined the understanding of exercise modality hierarchy in axSpA. Luo et al. (2024) confirmed that aquatic stretching exercise ranked highest for improving disease activity scores, followed by land-based aerobic exercise and land-based stretching, with all modalities providing significant benefit over control conditions [35]. For the sports medicine specialist managing an elite athlete with axSpA, this evidence supports a periodized rehabilitation approach: aquatic therapy during active inflammatory phases, transitioning to structured land-based programs during remission, and gradual reintegration into sport-specific drills as disease control is achieved. The quality of medical management in professional sports is ultimately measured by the seamless integration of these evidence-based movement protocols into the athlete's daily training routine, ensuring that rehabilitation and performance coexist rather than compete.

Table 1. *Summary of key studies included in the narrative review.*

Author (Year)	**Topic**	**Study Type**	**Key Finding**	**Ref.**
Navarro-Compán et al. (2021)	axSpA definition & classification	Review	Defines radiographic and non-radiographic axSpA spectrum; ASAS criteria discussed	[1]
Zhao et al. (2021)	Diagnostic delay	SR+ Meta-analysis	Mean diagnostic delay 6.7 years globally; younger age and absence of EAMs linked to longer delay	[4]

Hay et al. (2022)	Diagnostic delay	Systematic review	Median delay 5–8 years; female sex and non-rheumatology care identified as key barriers	[7]
Danve et al. (2024)	axSpA in sports medicine	Narrative review	First review addressing axSpA management for sports medicine professionals; role of NSAIDs and bDMARDs	[8]
Diekhoff et al. (2022)	MRI in axSpA	Review	Defines ASAS-positive MRI criteria; importance of BME localization and slice count	[13]
Ward & Yao (2022)	BME in athletes	Commentary	Exercise-induced BME mimics sacroiliitis; "innocent until proven guilty" approach advocated	[14]
Kiil et al. (2022)	MRI topography	Cross-sectional	Topographical differences between axSpA-related and mechanical BME in sacroiliac joints	[15]
Khan (2023)	i.HLA-B27	Review	50-year overview of HLA-B27 significance; prevalence and predictive value in axSpA	[19]
Ramiro et al. (2023)	ASAS-EULAR guidelines	Clinical guideline	2022 update: exercise elevated to first-line; “treat-to-target” strategy formalized	[23]
Deodhar et al. (2022)	JAK inhibitors (SELECT-AXIS 2)	Phase 3 RCT	Upadacitinib superior to placebo in nr-axSpA; ASAS40 response 45% vs 23%	[26]

Zhang et al. (2025)	Exercise therapy in axSpA	SR + Meta-analysis + Meta-regression	All exercise modalities reduce BASDAI/BASFI; combined aerobic + flexibility programs most effective	[30]
Carbo et al. (2025)	Physical activity & QoL	Prospective study	Meeting WHO activity targets correlates with lower disease activity and better QoL in axSpA	[33]
Luo et al. (2024)	Exercise modalities ranking	Network meta-analysis	Aquatic stretching ranks highest for BASDAI reduction; all modalities superior to control	[35]
WADA (2023)	Anti-doping / TUE	Regulatory document	ISTUE framework; glucocorticoids prohibited in-competition without TUE	[37]
Poddubnyy et al. (2025)	Global diagnostic delay	International survey	Mean delay 7.4 years across 27 countries; geographic and sociodemographic variation confirmed	[40]

***SR** = systematic review; **RCT** = randomized controlled trial; **BME** = bone marrow edema; **QoL** = quality of life; **EAMs** = extra-articular manifestations; **ASAS** = Assessment of SpondyloArthritis International Society; **WADA** = World Anti-Doping Agency; **TUE** = Therapeutic Use Exemption; **BASDAI** = Bath Ankylosing Spondylitis Disease Activity Index; **BASFI** = Bath Ankylosing Spondylitis Functional Index.*

8. Lifestyle and Patient Outcomes: The Quality of Life Perspective

The management of axial spondyloarthritis extends beyond clinical and pharmacological interventions, as lifestyle factors and daily physical activity patterns play a decisive role in long-term patient outcomes. Recent research highlights that for individuals suffering from chronic back pain, the quality of life is heavily influenced by their ability to maintain consistent activity while managing environmental stressors. Investigating these influences is critical for professional athletes, whose high-stress environment and unique lifestyle demands can either

exacerbate or enhance their recovery trajectory [36]. By analyzing the factors that contribute to symptom intensity, medical professionals can better tailor management strategies to improve the functional well-being of the athlete.

Quality of life in the context of axSpA is not merely the absence of pain but the preservation of the athlete's professional identity and physical autonomy. The integration of healthy lifestyle choices with structured medical care creates a synergistic effect that facilitates better disease control. It has been observed that patients who actively engage in understanding the exacerbating factors of their condition report higher levels of satisfaction with their medical services [36]. Therefore, the quality of medical management in elite sports must incorporate a holistic view, where lifestyle counseling is recognized as a fundamental pillar alongside traditional therapeutic modalities to ensure the highest possible standards of care and career longevity.

9. Anti-Doping Regulations and Therapeutic Use Exemptions

The medical management of axial spondyloarthritis in elite sports must be strictly aligned with the regulations established by the World Anti-Doping Agency (WADA). Many pharmacological agents used to control systemic inflammation, particularly systemic glucocorticoids, are prohibited in competition and require a formal Therapeutic Use Exemption (TUE) to ensure that the athlete remains compliant with international standards [37]. The TUE process is a critical quality indicator of medical management, as it allows athletes with documented chronic conditions to access necessary treatments without gaining an unfair performance advantage.

Recent statistical data from the Olympic and Paralympic cycles indicate a relatively low prevalence of TUEs among elite competitors, suggesting that the system is robust and prevents the misuse of medication under the guise of chronic illness [38]. For the effective treatment of axSpA, sports medicine physicians must be proactive in documenting the clinical necessity of bDMARDs or JAK inhibitors, even if these specific classes are not currently on the prohibited list. Ensuring transparency in the therapeutic pathway not only protects the health of the athlete but also maintains the integrity of the sport, preventing potential legal challenges and protecting the athlete's professional reputation [37, 38].

10. Conclusions and Future Directions

The diagnostic and therapeutic journey of an athlete with axial spondyloarthritis is characterized by unique and compounding challenges that demand a high level of clinical suspicion,

specialized interdisciplinary knowledge, and a willingness to adapt established rheumatological frameworks to a non-standard patient population. The central paradox of this condition in sports medicine lies in the fact that the very behaviors that define elite athletic identity — high pain tolerance, routine NSAID use, and the cultural normalization of physical suffering — are the same behaviors that most consistently delay accurate diagnosis and appropriate care.

The evidence reviewed here converges on several actionable conclusions. First, a mean diagnostic delay exceeding seven years remains unacceptable in 2026, particularly given the availability of validated screening tools such as ASAS inflammatory back pain criteria and the established predictive value of HLA-B27 testing [39, 40]. Sports medicine physicians, physiotherapists, and team doctors represent an underutilized primary point of contact: they see athletes with chronic back pain long before a rheumatologist is ever consulted. Proactive referral protocols — triggered by the presence of inflammatory back pain features, morning stiffness exceeding 30 minutes, and positive response to NSAIDs — should be formally implemented in high-performance sport settings.

Second, the MRI paradox of exercise-induced bone marrow edema demands a new standard of radiological literacy among sports medicine professionals. The integration of topographical lesion analysis with clinical and laboratory context is not optional — it is essential to avoid both overdiagnosis in healthy athletes and underdiagnosis in those with early axSpA. Radiological reports produced for athletic populations should explicitly address the mechanical versus inflammatory differential, referencing established criteria such as the ASAS MRI definitions [13, 14, 15].

Third, the therapeutic armamentarium for axSpA has expanded substantially, and the "treat-to-target" strategy now provides a framework that is compatible with athletic careers [29]. From NSAIDs through bDMARDs to JAK inhibitors, evidence-based escalation guided by validated activity indices ensures that pharmacological control does not preclude return to sport. Anti-doping compliance, particularly the proactive management of TUE documentation, must be integrated into the treatment plan from the outset [37, 38].

Finally, the most significant gap identified in this review is the complete absence of prospective, athlete-specific studies on axSpA. Every recommendation made here is extrapolated from general population data. Future research must prioritize longitudinal cohorts of competitive athletes with axSpA, aiming to establish sport-specific classification thresholds for inflammatory versus mechanical imaging findings, validated return-to-play protocols, and athlete-adapted "treat-to-target" benchmarks. Bridging this gap between sports science and

clinical rheumatology represents the defining challenge for the next decade of research in this field [41].

Disclosure

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