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Osteomyelitis Pain:The Hidden Factors Behind It and The Most Effective Treatments

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Abstract

Background: *Osteomyelitis is a complex bone infection that presents significant diagnostic and therapeutic challenges in adult orthopedic practice. Pain is not only a primary clinical manifestation but also a determinant of functional impairment and surgical decision-making.*

Objective: *This review aimed to evaluate the pathophysiological mechanisms, diagnostic approaches, and evidence-based protocols for pain management in osteomyelitis, specifically within orthopedic settings.*

Methods: *A narrative review was conducted based on the analysis of 30 peer-reviewed articles published between 2015 and 2025. Studies were selected for their relevance to adult osteomyelitis, pain mechanisms, orthopedic interventions, and multidisciplinary pain control strategies.*

Results: *Pain in osteomyelitis is multifactorial, involving inflammatory, mechanical, and neuropathic components. Diagnostic accuracy depends on clinical assessment combined with advanced imaging and microbiological confirmation. Pain management requires a multimodal approach that includes NSAIDs, opioids, neuropathic agents, surgical debridement, stabilization, local antibiotics, rehabilitation, and psychological support. The integration of these strategies is essential to reduce pain, prevent chronicity, and optimize orthopedic outcomes.*

Conclusion: *Effective pain control in osteomyelitis is critical for functional recovery and long-term patient outcomes. A multidisciplinary, personalized approach—rooted in orthopedic principles—ensures not only infection eradication but also pain resolution and quality of life enhancement.*

Keywords: Osteomyelitis, Pain management, Orthopedic surgery, Chronic bone infection, Multimodal therapy

1.Introduction

Osteomyelitis is a multifaceted infectious pathology of bone tissue marked by inflammatory processes that frequently evolve into chronic pain, particularly in adult patients with post-traumatic or long-standing infections. Within orthopedic clinical practice, pain constitutes a central axis in both diagnosis and treatment, significantly influencing functional outcomes, rehabilitation potential, and quality of life. This review was developed to synthesize findings from twenty peer-reviewed studies to consolidate current knowledge on the pathophysiological mechanisms underlying pain in osteomyelitis, evaluate established clinical management strategies, and examine therapeutic efficacy based on reported outcomes.

Clinically, osteomyelitis encompasses a heterogeneous group of disease presentations classified into acute and chronic forms, depending on symptom duration and clinical evolution. Etiologically, it may arise from hematogenous dissemination,

contiguous spread from adjacent soft tissue infections, or direct inoculation through trauma or surgical procedures [1,2]. The pathogenesis is rooted in a dynamic interplay between bacterial virulence—primarily Staphylococcus aureus biofilm formation—and host immunoinflammatory responses, culminating in structural bone compromise, such as cortical lysis, intramedullary abscesses, and sequestrum development [3,4].

Pain is a hallmark symptom and serves as a clinically significant indicator of disease burden, progression, and therapeutic response. In adults, it frequently manifests as a deep, focal, and persistent pain, exacerbated by pressure or mechanical stress, and often precedes radiological confirmation [5]. Its pathophysiological basis includes periosteal tension, marrow edema, and inflammatory mediator release. Chronic pain components may involve neuropathic mechanisms due to peripheral nerve infiltration or compression by inflamed osseous structures [6,7].

From a diagnostic standpoint, magnetic resonance imaging (MRI) remains the gold standard for early detection, with high sensitivity in identifying marrow signal alterations, cortical disruptions, and soft tissue abscesses [8,9]. Computed tomography (CT) and radionuclide imaging are particularly useful in detecting and evaluating cases complicated by orthopedic hardware, allowing correlation with symptom localization and intensity [10,11].

In orthopedic decision-making, pain not only reflects pathological severity but also guides the timing and extent of surgical intervention. Mainstays of treatment include radical debridement, dead-space management, and mechanical stabilization. Concurrently, systemic and local antibiotic therapies—based on culture-directed regimens—are imperative for infection eradication [12–14]. Nevertheless, even after microbiological cure, many patients continue to report pain due to residual structural damage, fibrotic remodeling, or persistent neuroinflammation [15–17].

Post-traumatic and implant-related osteomyelitis introduce additional layers of complexity, with polymicrobial biofilm formation and soft tissue involvement being common. These cases often necessitate staged surgical interventions, including local antibiotic carriers and advanced reconstructive techniques such as musculocutaneous or fasciocutaneous flaps to ensure soft tissue coverage and alleviate pain through mechanical protection [18–22].

Vertebral osteomyelitis, particularly in hematogenous forms, is rising in incidence among elderly and immunocompromised adults. Clinically, it presents with axial skeletal pain and occasionally neurological deficits. Early intervention is critical, as delayed decompression or stabilization may result in irreversible impairment. The intensity of pain in these cases has been correlated with compromised mobility, prolonged hospitalization, and decreased HRQoL [23,24].

Comprehensive pain management in osteomyelitis necessitates a multidisciplinary approach. Pharmacologic protocols often include nonsteroidal anti-inflammatory drugs (NSAIDs), opioids for breakthrough pain, and adjuvants such as gabapentinoids and serotonin-norepinephrine reuptake inhibitors (SNRIs) to address neuropathic components. Regional anesthesia and interventional pain techniques, including epidural blocks and peripheral nerve catheters, have shown efficacy in selected refractory cases [25–27].

Even following successful antimicrobial and surgical intervention, pain may persist due to biomechanical sequelae such as spinal deformity or altered load-bearing alignment. Long-term monitoring using validated instruments—such as the Visual Analog Scale (VAS), Numeric Rating Scale (NRS), and patient-reported outcome measures (PROMs) including EQ-5D and SF-36—allows for individualized rehabilitation planning and facilitates evaluation of pain-related disability over time [28–30].

Thus, a refined understanding of the orthopedic dimensions of pain in osteomyelitis is not only integral to infection control but also to optimizing patient recovery trajectories. Evidence-based pain control, aligned with surgical and rehabilitative principles, enhances patient outcomes, reduces chronicity, and supports reintegration into functional and social domains. The objective of this article is to conduct a comprehensive theoretical analysis of the mechanisms, clinical presentation, and management of pain in osteomyelitis from an orthopedic perspective, incorporating current evidence from twenty selected peer-reviewed studies to inform clinical decision-making and optimize patient care outcomes.

2. Methodology

This narrative review was designed to synthesize current evidence regarding pathophysiology, clinical characteristics, and therapeutic strategies for pain in adult patients with osteomyelitis, emphasizing orthopedic interventions. The review aimed to consolidate data published over the past ten years, covering the period from January 2015 to March 2025.

A comprehensive search of scientific literature was conducted using the electronic databases PubMed, Scopus, Embase, and the Cochrane Library. The search strategy employed a combination of keywords and Medical Subject Headings (MeSH) terms relevant to the scope of this review. Keywords included: osteomyelitis, bone infection, orthopedic infection, pain management, chronic pain in osteomyelitis, spinal osteomyelitis, surgical treatment of osteomyelitis, orthopedic outcomes, vertebral infection, and biofilm and bone infection. Boolean operators (AND/OR) were used to construct sensitive and specific search strings such as ("osteomyelitis" AND "pain") OR ("chronic osteomyelitis" AND "orthopedics").

To ensure methodological consistency, clear inclusion and exclusion criteria were applied. The inclusion criteria were: (a) peer-reviewed articles published in English between January 2015 and March 2025; (b) studies involving adult human subjects (≥18 years); (c) articles that directly addressed osteomyelitis-associated pain, its orthopedic implications, pathophysiology,

clinical evaluation, or therapeutic management; and (d) study types including original research, cohort studies, clinical trials, case series, systematic reviews, or meta-analyses.

The exclusion criteria were: (a) studies focusing solely on pediatric populations; (b) articles unrelated to pain assessment or orthopedic management; (c) in vitro or microbiological studies without clinical correlation; (d) studies related exclusively to non-orthopedic contexts (e.g., odontogenic osteomyelitis, head and neck infections, or malignancy-associated osteomyelitis); and (e) non-peer-reviewed materials such as conference abstracts, editorials, and letters to the editor.

The initial search yielded approximately 2,000 articles. After duplicate removal and screening of titles and abstracts, 84 full-text articles were evaluated. Based on the established eligibility criteria, 30 articles were selected for inclusion in this review. Article selection was conducted independently by two reviewers. Disagreements were resolved by consensus or, when necessary, by consultation with a third senior researcher to maintain methodological integrity.

A structured data extraction template was employed to collect relevant information from each study. Extracted data included publication details (author and year), study design, population characteristics, etiology and location of osteomyelitis, pain characteristics, assessment tools used (e.g., Visual Analog Scale [VAS], Numeric Rating Scale [NRS], EQ-5D), type of orthopedic and pharmacologic interventions applied, and pain-related outcomes. The analysis integrated both qualitative and quantitative insights, identifying recurring clinical patterns, therapeutic trends, and evidence-based recommendations.

As this review was based entirely on publicly available secondary data, institutional ethical approval was not required. All studies included were previously published in peer-reviewed journals and, where applicable, had obtained ethics committee approval. This review adhered to the standards for rigorous academic synthesis, aligning with the methodological principles outlined by the APA for non-empirical research.

3. Results and Discussion

3.1. Etiology of Pain in Osteomyelitis

Osteomyelitis in adult patients is an orthopedic condition that typically develops as a result of hematogenous spread, direct inoculation, or contiguous extension from adjacent infections. Each etiological pathway influences the onset, character, and intensity of pain, which is often the primary symptom prompting orthopedic consultation. Hematogenous osteomyelitis, most common in the elderly and immunocompromised populations, predominantly affects the vertebrae and is typically caused by Staphylococcus aureus. These cases present with localized spinal pain and can mimic degenerative or mechanical back disorders, often delaying diagnosis and treatment [1–3].

Contiguous osteomyelitis, frequently encountered in post-operative or trauma-related cases, presents a significant burden in orthopedic wards, particularly in patients with open fractures or those who have undergone prosthetic joint implantation. The direct spread of infection from infected ulcers or surgical sites to adjacent bone results in severe, localized nociceptive pain. This pain is typically exacerbated by weight-bearing or manipulation, signaling structural instability and active infection, necessitating immediate orthopedic intervention [4-6].

In cases of direct inoculation osteomyelitis, pain is not only inflammatory but also mechanical in origin, particularly in fractures complicated by infection. The process of periosteal elevation, accumulation of purulent material, and intramedullary pressure leads to significant pain and functional impairment. Biofilm formation on orthopedic implants further complicates the condition, providing a protected niche for bacteria and making both eradication and pain control more difficult [7-9].

Chronic osteomyelitis is often associated with persistent or recurrent pain, driven by a cycle of bone necrosis, sequestrum formation, and immune-mediated inflammation. In these cases, orthopedic surgeons face the dual challenge of managing the infection while also addressing long-standing pain that may become partially neuropathic in nature due to nerve compression or ischemia [10-12].

The orthopedic implications of osteomyelitis etiology are critical for both diagnostic classification and surgical planning. For instance, vertebral osteomyelitis requires imaging and stabilization strategies that differ significantly from those used in limb osteomyelitis associated with diabetic foot infections. Pain localization, pattern, and duration serve as clinical clues to the underlying infectious pathway and severity, influencing whether aggressive debridement or conservative management is appropriate [13-15].

Post-traumatic osteomyelitis, particularly in long bones, presents additional orthopedic complexity due to biomechanical disruption. In these patients, pain correlates strongly with instability, delayed union, or nonunion, and must be addressed concurrently with infection management. Orthopedic reconstruction with internal fixation or external devices is often needed to restore load-bearing capacity and reduce nociceptive stimuli [16-18].

Furthermore, the virulence of the infecting organism and the patient's systemic condition also modulate pain expression. For example, MRSA infections tend to provoke more aggressive local responses, which amplify pain and prolong inflammation. Patients with diabetes, peripheral vascular disease, or immunosuppression often present with atypical pain profiles, making orthopedic diagnosis and treatment planning more challenging [19-21].

In chronic stages, the interaction between persistent infection and degenerative changes in bone morphology may lead to joint involvement, increasing both the complexity of orthopedic surgery and the chronicity of pain. Such cases frequently require

multi-stage procedures and coordinated rehabilitation to address deformity and function loss [22-24].

Psychological factors, such as fear-avoidance behaviors and depression, often co-exist in chronic osteomyelitis and contribute to the perception of pain. These dimensions are particularly relevant in orthopedic rehabilitation and require integrated pain management strategies involving both pharmacological and psychological support [25,26].

Ultimately, understanding the etiological basis of pain in osteomyelitis provides orthopedic surgeons with critical insight into the disease's natural history and guides appropriate surgical and rehabilitative approaches. Multimodal strategies are necessary to effectively manage the structural, infectious, and neuropathic elements of pain in osteomyelitis [27–30].

3.2. Diagnostic Framework for Osteomyelitis-Related Pain

In orthopedic clinical practice, the accurate diagnosis of osteomyelitis-related pain demands a multifaceted approach that integrates clinical acumen with advanced diagnostic tools. Pain is often the sentinel symptom of osteomyelitis and frequently precedes overt radiographic or laboratory changes. It tends to be localized, persistent, and exacerbated by mechanical loading or palpation, characteristics that differentiate it from non-infectious orthopedic pain syndromes. Nevertheless, this pain is not pathognomonic and can mimic various musculoskeletal disorders such as degenerative joint disease, spinal stenosis, or neuropathic syndromes, necessitating a high index of suspicion among orthopedic specialists [2,3,10].

Initial diagnostic efforts typically involve plain radiographs, which, despite being widely available, have limited sensitivity in early-stage infection. Their utility lies in detecting chronic changes such as periosteal reaction, lytic lesions, and sclerosis, which generally emerge 10 to 14 days after symptom onset. Consequently, their role in acute diagnosis is complementary at best [7]. For a more sensitive evaluation, magnetic resonance imaging (MRI) is considered the imaging modality of choice. It can detect bone marrow edema, abscess formation, and soft tissue involvement within days of infection onset, offering critical spatial correlation with pain localization [3,13]. In the presence of metallic implants or in patients contraindicated for MRI, computed tomography (CT) scans provide superior cortical resolution and facilitate the identification of involucrum, and cortical breach, particularly in post-traumatic or hardware-associated osteomyelitis [15,17].

For diagnostically ambiguous cases, especially those involving recurrent or low-grade infections—nuclear medicine imaging plays a decisive role. Technetium-99m-labeled leukocyte scintigraphy and fluorodeoxyglucose positron emission tomography (FDG-PET) have demonstrated high sensitivity in detecting metabolically active foci of infection. These modalities are invaluable in cases where MRI or CT findings are equivocal, or when soft tissue and spinal involvement are suspected but not clearly delineated [11,14]. Nuclear imaging also aids in differentiating active infection from sterile inflammation or post-surgical changes, a frequent challenge in orthopedic oncology and revision arthroplasty.

A definitive diagnosis hinges on microbiological and histopathological confirmation via bone biopsy. For orthopedic surgeons, percutaneous or open bone biopsy not only aids in pathogen identification but also guides targeted antimicrobial therapy. This is particularly critical in chronic osteomyelitis, where biofilm-producing organisms can evade systemic antibiotics and present with culture-negative results. Biopsy should ideally be performed prior to antibiotic initiation to maximize diagnostic yield and avoid false negatives [3,20].

Laboratory tests, though non-specific, offer useful adjunctive information. Elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels are frequently observed and serve as markers of systemic inflammation. While their lack of specificity limits their diagnostic precision, serial monitoring provides valuable insight into disease activity and treatment response. Leukocyte counts may be normal, especially in chronic or immunosuppressed individuals, necessitating cautious interpretation [9].

In orthopedic decision-making, clinical evaluation remains indispensable. Characteristics of the patient's pain—such as its timing, progression, association with systemic symptoms, and response to mechanical stress—must be evaluated in conjunction with imaging and lab findings. For instance, nocturnal pain or pain unrelieved by rest may suggest an infectious etiology rather than degenerative disease. In spinal osteomyelitis, pain often correlates with vertebral body involvement and paravertebral abscess formation, necessitating prompt imaging and, potentially, spinal stabilization procedures [1,6].

The importance of timely and accurate diagnosis cannot be overstated in orthopedic practice, where delays may result in irreversible structural damage, compromised joint function, or the need for extensive reconstructive surgery. A misdiagnosis or delayed diagnosis often leads to progression from acute to chronic osteomyelitis, with increased risk of complications such as sinus tract formation, limb deformity, and chronic pain syndromes. Therefore, a high degree of diagnostic vigilance, particularly in patients with risk factors such as recent surgery, open fractures, diabetes, or vascular insufficiency, is essential. Multidisciplinary collaboration between orthopedic surgeons, radiologists, nuclear medicine specialists, and infectious disease experts ensures a comprehensive and accurate diagnostic workup. Ultimately, early detection and appropriate intervention not only mitigate infection but also alleviate pain and preserve musculoskeletal function, which are central goals in orthopedic patient care.

3.3. Pain Management Protocols in Orthopedic Osteomyelitis

Effective pain management in osteomyelitis is a cornerstone of comprehensive orthopedic care. Pain in this context arises from a complex interplay of infectious, inflammatory, and biomechanical factors. As such, management protocols must be multidisciplinary and tailored to the specific stage of infection, anatomical site, and

individual patient profile. Orthopedic interventions, both surgical and non-surgical, play a pivotal role in this multidimensional strategy.

Pharmacological approaches represent the first line of intervention. Nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen and naproxen, are widely utilized for managing acute pain related to inflammation. These agents inhibit cyclooxygenase enzymes, curbing prostaglandin production which mediates pain and swelling. Clinical data confirm their efficacy in early-stage osteomyelitis, yet caution is advised in patients with renal impairment or gastrointestinal comorbidities—common in older orthopedic populations [2,3,5]. When NSAIDs are insufficient, opioid analgesics such as morphine and oxycodone may be administered to address moderate-to-severe nociceptive pain. However, opioids are typically reserved for acute phases due to well-documented risks of dependency and interference with rehabilitation [8,10].

Neuropathic pain, particularly in chronic or vertebral osteomyelitis, is addressed using agents like gabapentin and duloxetine. These medications act on central and peripheral neural pathways, modulating pain perception. Studies demonstrate improved functional outcomes and reduced pain scores when these agents are incorporated early in the treatment of neurologically involved osteomyelitis [4,6,28].

Surgical intervention plays a crucial role in orthopedic pain control. Radical debridement excises necrotic tissue and reduces the microbial load, directly alleviating the source of inflammation and mechanical pressure. This approach is essential in chronic or hardware-associated osteomyelitis, where retained biofilm-coated implants perpetuate both infection and pain. In parallel, stabilization procedures using plates, rods, or external fixators correct mechanical instability, another major contributor to pain—particularly in long bone and spinal involvement [9,12,16].

Local antibiotic therapy provides a highly targeted method of infection and pain control. By embedding antibiotics in polymethylmethacrylate (PMMA) or calcium sulfate carriers, clinicians deliver high concentrations of antimicrobials directly to the site of infection. This technique has demonstrated significant reduction in local inflammation and pain intensity and is a mainstay in limb-salvage orthopedic protocols [18,19,22].

Rehabilitation is indispensable in orthopedic osteomyelitis care. Disuse atrophy and joint stiffness amplify musculoskeletal pain and functional limitation. Structured physiotherapy—including stretching, resistance exercises, and progressive mobilization—accelerates recovery and minimizes pain arising from mechanical overload or compensation. Evidence supports early engagement of rehabilitation services for optimal pain and mobility outcomes [25,27,30].

Equally essential is the psychosocial dimension of chronic pain management. Psychological interventions such as cognitive-behavioral therapy (CBT), relaxation techniques, and structured counseling have shown to alleviate pain perception and improve treatment adherence in patients with protracted disease courses or multiple surgical interventions [23,26,29].

The multimodal integration of these approaches yields superior outcomes compared to isolated treatments. Clinical trials and cohort studies have consistently shown that patients managed with coordinated pharmacologic, surgical, and rehabilitative protocols exhibit lower pain scores, faster return to function, and fewer complications. This is particularly critical in orthopedic scenarios where untreated pain impairs rehabilitation potential and compromises surgical results [15,21,28].

Table 1 presents a comprehensive overview of the principal strategies utilized for managing pain in osteomyelitis, particularly within orthopedic contexts. The table delineates each intervention based on its primary mechanism of action, clinical examples, and documented therapeutic outcomes. It underscores the diverse nature of pain in osteomyelitis—ranging from inflammatory and nociceptive to neuropathic and psychosomatic origins—requiring a tailored, multimodal approach. For instance, while NSAIDs and opioids provide short-term relief for acute pain, their limitations in chronic scenarios necessitate the inclusion of neuropathic agents such as gabapentin. Surgical strategies, including debridement and stabilization, directly mitigate pain by removing infected tissue and restoring mechanical function, respectively. Meanwhile, local antibiotic therapy allows for targeted anti-infective treatment with minimal systemic toxicity. Complementary rehabilitation and psychological interventions enhance long-term outcomes by addressing disuse-related and affective components of pain. As such, Table 1 reinforces the essential role of interdisciplinary coordination in optimizing pain control and functional recovery in patients with osteomyelitis.

Strategy	Target Mechanism	Examples	Clinical Impact and Supporting Studies
NSAIDs	Inflammatory pain	Ibuprofen, Naproxen	Short-term relief; limited by GI/renal risks [2,3,5]
Opioids	Acute nociceptive pain	Morphine, Oxycodone	Effective for acute control; risk of dependency [8,10]
Neuropathic agentes	Neural sensitization	Gabapentin, Duloxetine	Effective for chronic/spinal OM pain; improves QoL [4,6,28]
Surgical debridement	Necrotic/infected tissue	Excision, lavage	Reduces infectious burden and pain; often essential [9,12,16]

Stabilization procedures	Mechanical instability	Rods, plates, fixators	Enhances mobility; reduces motion-induced pain [12,16]
Local antibiotic therapy	Infection at bone site	PMMA beads, calcium sulfate	Decreases local inflammation and pain [18,19,22]
Physical rehabilitation	Disuse and compensatory pain	PT, resistance training	Restores function; lowers secondary pain [25,27,30]
Psychological support	Pain perception modulation	CBT, relaxation therapy	Reduces pain-related distress and fear-avoidance [23,26,29]

Legend: OM = osteomyelitis; GI = gastrointestinal; QoL = quality of life; PT = physical therapy; CBT = cognitive-behavioral therapy.

Table 1: Pain Management Strategies in Osteomyelitis

The data summarized in Table 1 underscore the necessity of a mechanism-based, individualized approach to pain management in osteomyelitis, particularly within the orthopedic domain. Pharmacological strategies such as nonsteroidal anti-inflammatory drugs (NSAIDs) and opioids remain essential in the initial control of inflammatory and acute nociceptive pain. NSAIDs like ibuprofen and naproxen are effective in the early inflammatory phase, yet their prolonged use is limited by gastrointestinal and renal side effects, which are particularly concerning in elderly or polymorbid orthopedic patients [2,3,5]. Similarly, while opioids such as morphine and oxycodone offer rapid analgesia, their risk profile, including tolerance, dependency, and cognitive impairment—demands cautious, short-term application, especially when patients are undergoing postoperative rehabilitation [8,10].

Surgical interventions emerge as critical components in managing osteomyelitis-related pain, especially in chronic or post-traumatic cases. Procedures such as radical debridement remove necrotic and infected tissue, thereby alleviating the primary source of inflammatory nociception [9,12,16]. Concurrently, mechanical stabilization using internal fixation or external devices addresses biomechanical instability—a major contributor to orthopedic pain, particularly in long bone and vertebral osteomyelitis. These interventions not only reduce pain but also enable earlier mobilization, improving the trajectory of functional recovery. Additionally, local antibiotic delivery systems, such as PMMA beads or calcium sulfate carriers, permit high local antimicrobial concentrations, minimizing systemic toxicity and indirectly reducing pain by accelerating infection resolution [18,19,22].

The rehabilitative dimension is equally vital in long-term orthopedic pain control. Physical therapy plays a central role in mitigating pain resulting from disuse, muscle atrophy, joint stiffness, and altered gait patterns—common sequelae following osteomyelitis episodes and surgical intervention. Evidence strongly supports early and progressive mobilization protocols, which improve strength, flexibility, and proprioception, ultimately reducing compensatory musculoskeletal pain and enhancing patient autonomy [25,27,30]. These strategies, when coordinated with surgical planning and pharmacologic control, provide a continuum of care essential for optimal orthopedic outcomes.

A particularly important insight from Table 1 is the tailored use of neuropathic agents, such as gabapentin and duloxetine, in scenarios involving nerve compression or spinal involvement. These agents modulate neural sensitization and are especially beneficial in chronic osteomyelitis or vertebral infections, where conventional analgesics may fail to address the neurogenic component of pain [4,6,28]. Their integration into orthopedic pain protocols represents a paradigm shift—moving from purely structural management to addressing the neurophysiological underpinnings of persistent pain. This reflects a more nuanced understanding of osteomyelitis, not merely as an infectious condition, but as a disorder with complex multisystemic pain manifestations.

Finally, psychological support interventions, including cognitive-behavioral therapy (CBT) and relaxation techniques, play a crucial and often underrecognized role in pain modulation. Chronic osteomyelitis is frequently accompanied by psychological distress due to prolonged treatment, recurrent hospitalizations, and functional limitations. These factors contribute to pain amplification through maladaptive coping behaviors, such as fear-avoidance and catastrophizing. Integrating psychological care into orthopedic rehabilitation not only improves emotional resilience but also enhances adherence to physical therapy, reduces opioid consumption, and facilitates a more complete recovery [23,26,29]. Altogether, the strategies outlined in Table 1 illustrate that managing pain in osteomyelitis requires a comprehensive, multidisciplinary, and patient-centered framework that aligns with best practices in modern orthopedic medicine.

5. Conclusion

This narrative review aimed to synthesize current evidence on the mechanisms and management of pain in osteomyelitis, with a specific focus on adult orthopedic settings. The critical appraisal of 30 peer-reviewed studies revealed that pain in osteomyelitis is multifactorial—arising from inflammatory, mechanical, and neuropathic components—and constitutes a central element in both diagnosis and therapeutic planning. In orthopedic practice, pain should not be regarded merely as a symptom but as a clinical marker of disease progression, structural instability, and therapeutic response.

The findings emphasize the necessity of a multidisciplinary and individualized approach to pain management. While pharmacological strategies are essential in the acute phase, they are insufficient when used in isolation, given the complexity of pain in osteomyelitis. In this context, surgical intervention—particularly aggressive debridement combined with biomechanical stabilization and local antimicrobial delivery—emerges as the most effective and definitive approach for both pain relief and infection control. Surgery not only facilitates the removal of infected and necrotic tissue but also restores the structural and functional integrity of the affected site, thereby contributing decisively to pain reduction and improvement in patients' quality of life.

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