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Review Article

Hidradenitis suppurativa: a comprehensive review of pathogenetic mechanisms, clinical phenotypes, and evolving therapeutic paradigms

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ABSTRACT

Hidradenitis suppurativa (HS), also known as acne inversa, is a chronic, recurrent, and debilitating inflammatory skin condition characterized by deep-seated nodules, abscesses, fistulating sinus tracts, and scarring, primarily affecting apocrine gland-bearing skin. Historically dismissed as a disorder of poor hygiene or mere follicular occlusion, contemporary research has redefined HS as a systemic immune-mediated disease with profound implications for patient quality of life and metabolic comorbidities. This exhaustive review synthesizes the most current understanding of HS pathogenesis, which is now recognized as a multifactorial interplay of genetic predisposition, follicular hyperkeratosis and occlusion, dysbiosis of the cutaneous microbiome, and a profound dysregulation of the innate and adaptive immune system, with a prominent role for interleukin (IL)-17, IL-1β, and tumor necrosis factor-alpha (TNF-α). We meticulously detail the clinical spectrum, from prodromal manifestations to advanced Hurley stage III disease, emphasizing the nuances of phenotype classification and the critical importance of early diagnosis to mitigate disease-associated morbidity. A principal focus is dedicated to the rapidly expanding therapeutic landscape, moving beyond traditional antibiotics and surgery to include biologic agents that target specific inflammatory cytokines, with adalimumab (anti-TNF) as a cornerstone and emerging evidence for secukinumab (anti-IL-17A) and apremilast (PDE4 inhibitor). We further examine the robust association of HS with cardiometabolic syndrome, inflammatory bowel disease, and psychiatric comorbidities, advocating for a holistic, multidisciplinary management approach. This review consolidates evidence from recent clinical trials, consensus guidelines, and mechanistic studies to provide a foundational resource for clinicians and researchers navigating the complexities of this challenging disease.

Keywords: Hidradenitis suppurativa, Acne inversa, Follicular occlusion, Interleukin-17, Tumor necrosis factor-alpha, Dysbiosis, Hurley staging, Adalimumab, Biologic therapy, Systemic comorbidity

INTRODUCTION

The clinical entity now known as hidradenitis suppurativa has traversed a long and often obscure path in the annals of dermatology. First described by Velpeau in 1839 and later termed by Verneuil in 1854, its etiology remained enigmatic for over a century, shrouded in terminological inaccuracy and therapeutic nihilism. A pivotal shift in perspective has occurred within the last two decades, catalyzed by advanced immunologic and genetic research, transforming HS from a perceived suppurative disorder of apocrine glands to a recognized chronic autoinflammatory disease of hair follicles. The prevailing pathogenetic model, the follicular occlusion tetrad, has been

significantly refined; initial follicular hyperkeratosis and subsequent rupture are now understood to trigger an intense, aberrant immune response, creating a self-perpetuating cycle of inflammation, tissue destruction, and attempted repair. Groundbreaking genome-wide association studies have identified polymorphisms in genes encoding components of the γ-secretase complex (NCSTN, PSENEN, PSEN1), implicating Notch signaling pathway dysfunction in follicular integrity. Concurrently, molecular profiling of lesional skin has revealed a signature dominated by IL-17, IL-1, and TNF-α, positioning HS within the spectrum of Th17-mediated pathologies and providing a rational basis for targeted biologic interventions. The disease burden is staggering, with patients frequently enduring a diagnostic delay averaging seven years, during which uncontrolled inflammation leads to progressive anatomical damage, chronic pain, malodorous drainage, and profound social stigmatization. Furthermore, the systemic nature of HS is incontrovertible, with epidemiologic studies consistently demonstrating increased prevalences of obesity, smoking, metabolic syndrome, spondyloarthritis, and depression, necessitating a broader clinical view beyond the integument.[1-3]

This comprehensive review aims to distill the current state of knowledge, integrating foundational concepts with cutting-edge discoveries from recent literature to furnish a detailed, authoritative, and clinically relevant synthesis of HS. We will traverse its intricate pathophysiology, heterogenous clinical presentations, validated assessment tools, and an increasingly nuanced therapeutic algorithm that promises improved outcomes for a patient population long marginalized within healthcare systems. The synthesis presented herein is informed by a critical appraisal of contemporary sources, including the 2023 updates from the European S1 guideline, findings from the SHARPS research collective, and recent phase III clinical trial data published in journals such as The Lancet, JAMA Dermatology, and The British Journal of Dermatology.[4-6]

BACKGROUND

Hidradenitis suppurativa represents a profound clinical and scientific enigma, a disease whose true nature has only begun to coalesce into clear focus after generations of misunderstanding and neglect. Its historical journey is marked by a nomenclature that has inadvertently obscured its essence—from Velpeau's early descriptions to Verneuil's attribution to apocrine glands, which bestowed the misleading synonym "acne inversa". For decades, this lexicon anchored the condition to a model of primary infection or excretory dysfunction, fostering therapeutic approaches centered on antiseptics, prolonged antibiotics, and radical surgery. The turning point in this narrative arrived with the seminal work of Jemec and colleagues in the late 20th century, which systematically delineated its epidemiology and clinical course, forcing a reckoning with its chronic, inflammatory character. The contemporary era, defined by molecular biology and immunology, has fundamentally recast HS not as a disease of glands but as a disorder of follicular epithelium and immune dysregulation.[7]

The cornerstone of modern pathogenesis rests on the concept of the follicular occlusion. Initiated by hyperkeratosis and subsequent plugging of the infundibular portion of the hair follicle, this primary event creates a confined, hypoxic environment ripe for follicular dilation and eventual rupture. The extrusion of keratinous debris, bacterial antigens, and damage-associated molecular patterns (DAMPs) into the surrounding dermis acts as the critical incendiary event. It is this rupture that ignites a formidable innate immune response, characterized by a robust influx of neutrophils, macrophages, and dendritic cells.

Research from groups like those of Sabat and Wolk has meticulously decoded the cytokine milieu of this response, revealing a dominant signature involving interleukin (IL)-1β, tumor necrosis factor-alpha (TNF-α), and, most pivotally, IL-17. The presence of IL-23 and IL-17-producing T-helper 17 (Th17) cells and neutrophils positions HS firmly within the IL-23/Th17 axis, a pathway shared with psoriasis and inflammatory bowel disease, explaining the clinical overlap observed with these conditions.[8]

Genetic insights have provided a crucial etiological layer. Familial aggregation studies pointed to a heritable component, now substantiated by the discovery of loss-of-function mutations in genes encoding components of the γ-secretase complex—NCSTN, PSENEN, and PSEN1. This complex is integral to the Notch signaling pathway, a fundamental regulator of cell fate determination and follicular differentiation. Disruption of Notch signaling, as demonstrated in murine models, leads to cyst formation and a pro-inflammatory state, providing a compelling genetic substrate for the initial follicular fragility. However, the incomplete penetrance and rarity of these mutations underscore the disease's multifactorial nature, where genetic susceptibility interacts with potent environmental triggers, most notably smoking and obesity.[9]

The role of the cutaneous microbiome has been radically reevaluated. While early cultures implicated *Staphylococcus aureus*, advanced metagenomic sequencing techniques reveal a more complex dysbiosis rather than a classic infection. The follicular microbiome in HS is characterized by a decreased diversity and a shift in composition. Although coagulase-negative *Staphylococci, Corynebacterium* species, and anaerobes like *Prevotella* and *Porphyromonas* are prevalent, their pathogenic role appears to be permissive and synergistic within the inflamed milieu, amplifying the immune response through toll-like receptor engagement and biofilm formation, rather than acting as primary invaders.[10]

Clinically, the disease manifests as a spectrum, challenging early recognition. The prodromal phase of localized tenderness, burning, or pruritus is often overlooked. The progression from solitary, deep-seated nodules to interconnected sinus tracts (tunnels) and ropy, cribriform scarring encapsulates a trajectory of unchecked inflammation. The Hurley staging system, while invaluable for snapshot severity, fails to capture the dynamic burden of pain, drainage, and functional impairment, leading to the development of more sensitive tools like the hidradenitis suppurativa clinical response (HiSCR) and patient-reported outcome measures. The systemic burden is now undeniable; robust epidemiological data link HS to a heightened prevalence of metabolic syndrome, cardiovascular disease, arthropathies, and mood disorders, framing it as a systemic inflammatory condition with cutaneous predilection.[11]

Therapeutic evolution has mirrored this pathogenetic enlightenment. The traditional mainstay of clindamycin and rifampin combination therapy is now understood to exert primarily anti-inflammatory effects. The landmark approval of adalimumab, a monoclonal TNF-α inhibitor, validated the cytokine-targeting approach and revolutionized management for moderate-to-severe disease. Current therapeutic exploration is intensely focused on the IL-17 and IL-1 pathways, with secukinumab and bimekizumab showing significant promise in recent phase III trials, as reported in The New England Journal of Medicine and The Lancet. Janus kinase (JAK) inhibitors and novel small molecules also populate an increasingly crowded pipeline. This rapid advancement, however, highlights the persistent gaps: the absence of a true disease-modifying agent, the challenge of primary prevention, and the urgent need for biomarkers to predict therapeutic response. The present review is constructed upon this intricate foundation, drawing from the most current consensus guidelines, including the 2023 addenda to the European S1 guideline, and seminal papers from the past five years to provide a synthesized, critical, and forward-looking examination of a disease finally emerging from the shadows.[12]

CLINICAL MANIFESTATIONS

The clinical presentation of hidradenitis suppurativa is a testament to its chronic and relapsing nature, unfolding across a variable timeline that often delays diagnosis for years. Initial manifestations are frequently subtle and nonspecific, leading to frequent misdiagnosis. A significant proportion of patients report a prodromal phase characterized by localized sensory phenomena, including pruritus, burning sensations, tenderness, or excessive sweating (hyperhidrosis) in the affected areas. This premonitory stage, which can last for hours to days, is a critical but often overlooked window into the underlying follicular inflammation. The disease then declares itself more overtly with the development of deep-seated, firm, and exquisitely painful nodules. These lesions are not superficial folliculitis but originate deep within the dermis and subcutis, corresponding to the initial site of follicular distension and occlusion. Their palpation reveals a well-defined, "cord-like" or bean-shaped consistency, often mistaken for furuncles.[13]

The natural history of these nodules is heterogeneous and defines the disease's activity. A subset may resolve spontaneously over several days to weeks, often without suppuration, leaving temporary hyperpigmentation or induration. However, a more pathognomonic progression involves the central necrosis and liquefaction of the inflammatory infiltrate, leading to the formation of fluctuant abscesses. These abscesses may eventually point and drain a mixture of serous, mucopurulent, or frankly purulent material, typically malodorous. It is this malodor, coupled with chronic drainage, that inflicts profound psychosocial morbidity, contributing to social isolation, depression, and anxiety. The temporary relief following spontaneous rupture is often short-lived, as the underlying inflammatory process remains active.[13]

The hallmark of established HS, and the feature that distinguishes it from recurrent boils, is the development of sinus tracts, or "tunnels." These are epithelialized, subepidermal conduits that form as the body attempts to wall off and drain persistent inflammation. They represent a failure of resolution and are a sign of chronicity. On palpation, these tracts are felt as firm, cord-like structures beneath apparently normal or scarred skin. Their openings on the skin surface may appear as double-ended comedones, often described as "tombstone" comedones, or as intermittently draining fistulae. The interconnected network of these sinus tracts, along with persistent abscesses and fibrosis, leads to the formation of ropy, band-like, and eventually cribriform scarring. This scarring is typically dermal and can cause significant contractures, restricting mobility in areas such as the axillae or groin.[13]

The anatomical distribution of lesions is non-random and follows regions rich in terminal hair follicles and apocrine glands. The most commonly involved sites are the intertriginous areas: the axillae, inguinal folds, perineal and perianal region, and infra-mammary folds in women. Gluteal involvement is particularly common and can be severe. Other sites include the pubic region, thighs, and, less frequently, the retroauricular area, scalp, and waistband. The pattern is often symmetrical but can be strikingly unilateral. Recent phenotypic classifications, moving beyond Hurley staging, seek to categorize patients based on the predominant lesion type and location—such as follicular, gluteal, or mixed—which may have implications for disease trajectory and therapeutic response.[14]

Beyond the local cutaneous devastation, the clinical spectrum of HS is inextricably linked to a constellation of systemic manifestations and comorbidities. The chronic inflammatory burden, driven by elevated circulating cytokines like TNF-α and IL-6, is implicated in the strong

association with metabolic syndrome, insulin resistance, and an elevated risk of major adverse cardiovascular events. Musculoskeletal manifestations, including peripheral arthritis, arthralgias, and spondyloarthritis, are frequently reported. The overlap with inflammatory bowel disease, particularly Crohn's disease, is well-documented and believed to share a common Th17-driven pathophysiology. Furthermore, the unremitting pain, disfigurement, and social stigma precipitate a high prevalence of psychiatric comorbidities, including major depressive disorder and generalized anxiety, creating a vicious cycle where psychological distress may potentially exacerbate disease activity. Thus, the clinical evaluation of a patient with HS demands a holistic approach, extending far beyond a simple count of nodules and abscesses to encompass a detailed assessment of pain severity, quality of life impairment, functional limitations, and systematic screening for associated conditions, as emphasized in the most recent international consensus guidelines and management pathways published in dermatology literature over the past several years.[15]

DIAGNOSIS

Establishing a definitive diagnosis of hidradenitis suppurativa remains a significant clinical challenge, one that is unfortunately belied by the seeming clarity of its most advanced lesions. The protracted diagnostic delay, averaging between seven to ten years from symptom onset, stands as a stark indictment of persistent gaps in disease recognition and underscores the necessity for heightened diagnostic acumen. This delay is multifactorial, arising from patient hesitancy to discuss symptoms in socially sensitive areas, frequent misattribution of lesions to recurrent infection or poor hygiene by both patients and clinicians, and the inherent variability of early-stage presentations. Contemporary diagnostic practice therefore hinges on a synthesis of clinical criteria, meticulous history-taking, and the judicious exclusion of mimickers, as there exists no single pathognomonic laboratory test or histologic finding. The diagnostic cornerstone is the identification of a characteristic disease course, typified by chronicity, recurrence, and progression, rather than the isolated examination of a single lesion.[15]

The most widely adopted and validated diagnostic criteria are those established by the Second International Hidradenitis Suppurativa Research Symposium. According to these consensus guidelines, a diagnosis of HS requires the fulfillment of three fundamental elements. First, the presence of typical lesions is essential. These are defined as deep-seated, painful nodules, often described as "blind boils" in early stages, progressing to abscesses, draining sinus tracts (tunnels), and eventually, bridging scars and double-ended pseudocomedones. Second, these lesions must manifest in a characteristic anatomical distribution, predominantly affecting the intertriginous and follicular-rich areas of the body. The axillae, inguino-genital region, perineal and perianal areas, buttocks, and infra-mammary folds constitute the primary sites. Third, and perhaps most critically, the disease must demonstrate a chronic and relapsing nature. A one-time occurrence of a furuncle or an isolated abscess does not satisfy this criterion. The history must reveal a pattern of recurrence over time, typically with new lesions developing as older ones resolve or persist, confirming the ongoing, systemic inflammatory process.[15]

The clinical encounter must therefore prioritize a detailed, and often sensitive, patient history. Probing questions should aim to reconstruct the disease timeline, focusing on the age of onset—which peaks in the second and third decades—the precise description of the very first episode, the frequency of flares, and the specific triggers perceived by the patient, such as hormonal cycles, stress, or friction. A thorough review of prior treatments, including over-the-counter remedies, antibiotic courses, and surgical interventions, provides insight into disease duration and severity. The physical examination must be comprehensive and conducted under adequate lighting. It involves not only visual inspection but also systematic palpation of all typical sites to detect subclinical nodules, subtle cord-like sinus tracts beneath the skin, and areas of scarring that the patient may not have associated with active disease. The characteristic odor, while not always present, can be a supportive clue. Examination should also note the presence of other cutaneous stigmata of follicular occlusion, such as pilonidal sinus or severe acne vulgaris, which may support the diagnosis.[15]

Differential diagnosis is a pivotal component of the diagnostic process, requiring the clinician to distinguish HS from a spectrum of conditions that can present with nodules, abscesses, and fistulae in similar locations. These include recurrent furunculosis or carbuncles, complicated cutaneous Crohn's disease (which can be indistinguishable from perianal HS and often coexists), pilonidal disease, severe acne conglobata, granulomatous conditions like tuberculosis or actinomycosis, and lymphogranuloma venereum. In atypical or refractory cases, histopathological examination, while not routinely required for diagnosis, can be invaluable. Typical findings include follicular hyperkeratosis and dilation, perifollicular lympho-histiocytic inflammation, follicular rupture with a robust neutrophilic and granulomatous response, and eventually, fibrosis and epithelialized sinus tracts. Imaging modalities, particularly high-frequency ultrasound and magnetic resonance imaging, are emerging as powerful adjuncts, especially for mapping subclinical disease extent, assessing deep structural involvement, and planning surgical interventions. Ultrasound can visualize non-inflamed subcutaneous tunnels, fluid collections, and alterations in dermal echogenicity long before they become clinically apparent.[16]

Ultimately, modern diagnosis transcends mere lesion counting. It is an integrative exercise that weaves together pattern recognition, a deep understanding of the disease's natural history, and an appreciation for its profound systemic and psychosocial dimensions. The development

and validation of novel diagnostic biomarkers, such as specific serum cytokine profiles or genetic markers, remain an active area of investigation but are not yet ready for routine clinical use. Therefore, current best practice, as reflected in the most recent European S1 guideline updates and position papers from the HS Foundation, advocates for early referral to a dermatologist familiar with the disease, the use of validated screening questionnaires in high-risk populations, and a low threshold for considering HS in any patient presenting with recurrent inflammatory nodules in characteristic areas. Reducing diagnostic latency is arguably the most critical first step in altering the disease's devastating trajectory, preventing irreversible anatomical damage, and initiating appropriate, targeted therapy to mitigate the immense burden of this condition.[17]

TREATMENT

The therapeutic landscape for hidradenitis suppurativa has undergone a profound and necessary evolution, transitioning from an era characterized by empiricism and surgical destructiveness to a new paradigm grounded in targeted immunomodulation and staged, multidisciplinary management. This shift reflects the hard-won understanding of HS as a chronic, systemic, immune-mediated disease rather than a recalcitrant infection. Contemporary treatment philosophy is no longer focused solely on acute lesion resolution but is fundamentally oriented towards long-term disease control, suppression of inflammatory activity, prevention of structural damage, and mitigation of the profound comorbidity burden. Guiding principles emphasize that management must be tailored to disease severity—assessed through dynamic tools like the hidradenitis suppurativa clinical response (HISCR) and patient-reported outcomes—and to the individual's phenotypic presentation, with particular attention to the presence of tunneling and scarring.[18]

For patients with mild to moderate disease, typically corresponding to Hurley stage i and early stage ii, first-line medical management continues to involve topical therapies and systemic antibiotics with primary anti-inflammatory properties. Topical clindamycin remains a cornerstone for its ability to reduce inflammatory nodules and abscesses, though its efficacy is more modest against established sinus tracts. Recent evidence supports the use of resorcinol peels as a chemical anti-inflammatory agent, capable of reducing pain and inflammation in early lesions. The most significant advancement in this stratum, however, is the validated role of systemic antibiotics used not for their antimicrobial but for their immunomodulatory effects. The combination of clindamycin and rifampin, supported by long-standing clinical data, exerts a potent effect on the Th17-mediated inflammation central to HS pathogenesis. Similarly, tetracycline-class antibiotics like doxycycline or minocycline are frequently employed for their broader anti-inflammatory profile. These regimens are typically prescribed for limited courses of several months to induce remission, but their long-term use is constrained by gastrointestinal side effects and the theoretical risk of bacterial resistance, necessitating careful patient monitoring.[18]

The advent of biologic therapy has irrevocably altered the prognosis for moderate to severe HS (hurley stage ii and iii), marking the single most important therapeutic breakthrough. Adalimumab, a fully human monoclonal antibody targeting TNF-α, stands as the first and only biologic globally approved for this indication. Its efficacy, demonstrated in the pivotal pioneer trials, lies in its capacity to significantly reduce inflammatory lesion counts, achieve HISCR response, and ameliorate pain. However, clinical experience reveals a spectrum of response, with some patients exhibiting primary non-response or secondary loss of efficacy over time, highlighting the pathogenic heterogeneity of the disease. This has fueled intensive investigation into alternative cytokine targets. The IL-17 pathway has emerged as a particularly promising frontier. Secukinumab, an IL-17a inhibitor, has shown compelling efficacy in phase III trials (sunshine and sunrise), leading to its recent approval for HS in several regions. Even more potent blockade appears achievable with bimekizumab, a monoclonal antibody neutralizing both IL-17a and IL-17f, which has demonstrated superior efficacy outcomes in recent studies published in the New England Journal of Medicine, suggesting a potentially transformative role for dual cytokine inhibition. Concurrently, the IL-1 pathway is being explored, with ongoing research into agents like anakinra and bermekimab, though their place in the treatment algorithm remains under definition. The Janus kinase (JAK) inhibitors, such as infliximab and tofacitinib, are also under investigation, offering an oral small-molecule approach to disrupting inflammatory signaling cascades.[18]

Surgical and procedural interventions retain an indispensable, albeit more refined, role within the comprehensive treatment armamentarium. The old model of repeated incision and drainage for fluctuating abscesses is now strongly discouraged, as it provides only transient relief and may promote further scarring. Modern surgical philosophy is strategically integrated with medical control. For localized, recalcitrant nodules or sinus tracts, deroofing—a procedure involving unroofing the entire lesion and allowing healing by secondary intention—has proven highly effective and recurrence-preventive. In cases of severe, stable disease confined to a specific anatomical region, wide local excision with the intent of complete removal of the affected tissue offers the best chance for prolonged remission. The critical evolution here is the emphasis on achieving optimal medical control of peripheral inflammation prior to any major excision to improve surgical outcomes and reduce recurrence at the margins. Laser therapy, particularly with the nd: yag and carbon dioxide devices, provides a valuable intermediate option for hair follicle destruction and ablation of sinus tracts, supported by a growing body of clinical evidence.[19]

Ultimately, effective management is inseparable from a holistic, patient-centric approach. This necessitates

rigorous attention to comorbidity management, including weight loss counseling, smoking cessation support, and screening for metabolic, arthritic, and depressive disorders. pain management, often requiring a multimodal strategy incorporating neuropathic agents, is a critical pillar of care. The integration of wound care specialists, mental health professionals, and nutritionists into the care team is increasingly recognized as standard for advanced disease. the future of HS treatment lies in personalized medicine: the ability to predict which pathogenetic pathway dominates in a given individual—be it TNF, IL-17, or another—and to select a biologic agent accordingly, potentially guided by serum or tissue biomarkers. Until such tools are fully realized, current best practice, as consolidated in the 2023 European S1 guideline update and recent international consensus statements, advocates for a proactive, treat-to-target strategy, escalating therapy promptly in the face of inadequate response, with the overarching goal of restoring quality of life and altering the previously inexorable course of this devastating disease.[19]

CONCLUSION

Hidradenitis suppurativa has emerged from the obscurity of historical misunderstanding to claim its rightful place as a formidable and complex immune-mediated disorder of follicular epithelium. this comprehensive review underscores the dramatic evolution in our conceptualization of the disease, from a localized suppurative process to a systemic inflammatory condition with profound dermatological and extracutaneous ramifications. The elucidation of its pathogenesis, centered on follicular occlusion, subsequent rupture, and a dysregulated immune response dominated by the IL-23/th17 axis, has provided the critical molecular rationale for the therapeutic revolution currently underway. The once barren therapeutic landscape has been transformed by the advent of targeted biologic agents, with adalimumab establishing a new standard of care and the rapid subsequent emergence of potent IL-17 inhibitors like Secukinumab and Bimekizumab offering renewed hope for patients with refractory disease. These advancements represent more than just new drugs; they signify a paradigm shift towards precision medicine, where intervention is aimed at the core inflammatory drivers rather than mere symptom palliation.

Despite these significant strides, substantial challenges persist on the horizon. the protracted diagnostic delay remains an unconscionable barrier to care, perpetuating preventable morbidity and underscoring the urgent need for improved disease recognition across medical disciplines. While therapeutic options have expanded, the quest for a true disease-modifying agent continues. Not all patients respond adequately to existing biologics, and the patterns of primary non-response and secondary failure highlight the pathogenic heterogeneity of HS, suggesting the existence of distinct endotypes that may require tailored therapeutic strategies. The development of reliable predictive biomarkers—whether serological, genetic, or microbiomic—to guide therapy selection is arguably the most pressing unmet need in current clinical research. Furthermore, the management of advanced scarring and sinus tract disease still relies heavily on surgical expertise, emphasizing the irreplaceable role of a skilled multidisciplinary team that integrates medical, surgical, and psychological care seamlessly.

Future directions in HS research must adopt a holistic and patient-centered focus. investigation into the mechanisms linking HS to its metabolic and psychiatric comorbidities will be crucial for developing integrated care models that address the whole patient, not just their skin. Long-term outcome studies are needed to determine the impact of early and aggressive biologic intervention on preventing irreversible anatomical damage and altering the natural history of the disease. Similarly, dedicated research into the specific burdens of pain and fatigue, which are often disproportionate to objective lesion counts, is essential for developing comprehensive supportive care protocols. The continued refinement of phenotypic classification systems, moving beyond the static hurley stages to incorporate dynamic measures of inflammation and damage, will enhance clinical trial design and the personalization of treatment algorithms.

In closing, the journey of hidradenitis suppurativa from a neglected entity to a focus of intense clinical and scientific inquiry is a testament to persistent advocacy and investigative rigor. While the pathophysiological puzzle is not yet fully assembled, the pieces are falling into place with increasing clarity. The current era is one of cautious optimism, fueled by an expanding therapeutic arsenal and a deeper appreciation of the disease's systemic nature. The ultimate goal remains unwavering: to transform HS from a devastating and life-altering condition into a chronically manageable one. Achieving this will require sustained collaboration across specialties, continued investment in basic and translational research, and an unwavering commitment to placing the patient's lived experience at the center of all diagnostic and therapeutic endeavors. The insights gleaned from recent years, as documented in the latest consensus guidelines and high-impact clinical trials, provide a robust foundation upon which to build this future, promising improved quality of life and tangible hope for the global community of patients navigating this challenging disease.

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