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North American clinical management guidelines for hidradenitis suppurativa: A publication from the United States and Canadian Hidradenitis Suppurativa Foundations:

Part I: Diagnosis, evaluation, and the use of complementary and procedural management

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Abstract

Hidradenitis suppurativa is a chronic inflammatory disorder affecting hair follicles, with profoundly negative impact on patient quality of life. Evidence informing ideal evaluation and management of patients with hidradenitis suppurativa is still sparse in many areas, but it has grown substantially in the last decade. Part I of this evidence-based guideline is presented to support health care practitioners as they select optimal management strategies, including diagnostic testing, comorbidity screening, and both complementary and procedural treatment options. Recommendations and evidence grading based on the evidence available at the time of the review are provided.

Keywords

acne inversa; adalimumab; biomarkers; carbon dioxide laser; clindamycin; comorbidities; ertapenem; finasteride; guidelines; hidradenitis suppurativa; infliximab; laser; lifestyle modification; microbiome; Nd:YAG; oral contraceptive pills; rifampin; spironolactone

DISCLAIMER

The purpose of these guidelines is to summarize the available data at the time of preparation. It is possible that certain treatments or procedures are not included, as the primary literature review concluded on March 16, 2017, with only selected updates of high clinical impact through December 1, 2018. Given the difficulty in treating hidradenitis suppurativa (HS), there is no guarantee that following the guidelines will result in successful treatment. Moreover, the guidelines are not meant to set a standard of care. Care of a patient with HS is ultimately guided by the physician and patient, with an emphasis on factors unique to individual patients.

SCOPE

The guidelines address management of patients presenting with HS and discuss various treatments and procedures available at the time of preparation. In Part I of the guidelines

the evidence available to guide screening for comorbidities, grading/classification of disease, procedural management, and alternative/complementary treatments are reviewed and graded as outlined in Table I.

METHODS

Details on the methods used are available online (www.hs-foundation.org).

DEFINITION AND DIAGNOSIS

HS/acne inversa is a chronic, inflammatory, recurrent, debilitating skin disease of the hair follicle that usually develops after puberty and presents with painful inflammatory nodules, abscesses, comedones, scarring, and tunneling sinus tracts, with predilection for intertriginous areas of the body (most commonly the axillae and inguinal and anogenital regions). Diagnosis relies on clinical findings of (1) typical HS lesions, (2) predilection for intertriginous sites, and (3) recurrence.

INTRODUCTION

HS has received growing attention in recent years. The prevalence of HS ranges from 0.1% to 2%,¹⁵³⁻¹⁵⁵ with predilection for patients who are in the third and fourth decades of life,¹⁵³⁻¹⁵⁸ female,^{38,153,155,157} of African descent,^{156,159-161} and of lower socioeconomic status.^{162,163} HS significantly reduces quality of life as a result of physical, emotional, and psychologic consequences.¹⁶⁴ Furthermore, in part because of hospitalization and emergency department costs, HS potentially presents a significant financial burden to society.¹⁶⁵

Our understanding of HS is changing, and new studies suggest genetic susceptibility (eg, γ -secretase/Notch pathway mutations) and dysregulation in the innate and adaptive (eg, type 1 and type 17 helper T cells) immune pathways.¹⁶⁶⁻¹⁶⁸ Treatment of HS is similarly evolving, with emphasis on combining both medical and surgical approaches when appropriate. The widely variable activity and outcome measures used in the available evidence on HS management make drawing comparisons between treatment options challenging.¹⁶⁹

SYSTEMS FOR THE GRADING AND CLASSIFICATION OF HS

Numerous tools for assessment of patients with HS have been described (Table II). Most severity measurements include lesion counts of inflammatory nodules, noninflammatory nodules, sinuses/fistulas (draining or otherwise), scarring, and surface area affected. Pain is a particularly important outcome measure.

In the clinical setting, Hurley staging is recommended, as it is simple and helps determine therapeutic needs. Hurley stage I is characterized by recurrent nodules and abscesses with minimal scar, Hurley stage II is characterized by 1 or a limited number of sinuses and/or scarring within a body region, and Hurley stage III is characterized by multiple or extensive sinuses and/or scarring.¹⁷⁰ Inflammatory lesion counts (abscesses and inflammatory nodules) are the underlying basis of several validated measures, are feasible to perform,

and may facilitate therapeutic decisions and assessment of clinical response.¹ Pain visual analog scale scores and Dermatology Life Quality Index (DLQI) are valuable adjuncts and straightforward to perform in clinical settings.¹⁻⁶

In research settings, the Hidradenitis Suppurativa Clinical Response is the most validated dynamic physical measure for assessing treatment response,² but like the Hidradenitis Suppurativa Physician's Global Assessment and Sartorius score, it may have lower utility in the clinical setting. Patient-reported outcomes to consider include the DLQI score, pain visual analog scale, and HS-specific patient-reported outcomes (Hidradenitis Suppurativa Impact Assessment and Hidradenitis Suppurativa Symptom Assessment).⁶ A multinational effort developing a core outcome set in HS clinical trials is currently under way.¹⁷¹

ROLE OF DIAGNOSTIC TESTING IN EVALUATING PATIENTS WITH HS

At present, microbiologic screening has limited utility in HS. Mixed normal flora and skin commensals are the main bacteria cultured from suppurative discharge, though specific culture techniques have characterized an abundance of gram-negative organisms in some HS lesions.^{8,12,172,173} Biofilms, which are aggregates of bacteria in a protective extracellular polymeric substance, have been described in most HS skin samples, especially in sinus tracts, particularly when compared with control skin of healthy volunteers.^{8,174} Although their role in HS pathogenesis is not yet elucidated, biofilms may offer a therapeutic target for HS in the future. A negative culture may support a diagnosis of HS based on consensus-derived diagnostic criteria, but culture is not recommended in clinical practice unless signs of secondary infection such as surrounding cellulitis or fever are present.⁷

Small cohort studies have linked HS to biomarkers such as erythrocyte sedimentation rate,²² C-reactive protein,^{20,22} tumor necrosis factor,²³ interleukin 6 (IL-6),³³ IL-17A,²⁵ and others,^{24,29,31,32,175} whereas levels of leukotriene A4 hydrolase, follicle-stimulating hormone, human chorionic gonadotropin, and luteinizing hormone were decreased in HS.¹⁶ Similarly, small cohorts have linked mutations in the γ -secretase complex,¹⁷ higher β -defensin copy numbers,¹⁸ and infrequent single nucleotide polymorphisms in tumor necrosis factor²⁸ and IL-12RB1¹⁹ to HS, but there is no current role for genetic or biomarker testing in diagnosis.

ROLE OF SCREENING FOR COMORBIDITIES IN HS

HS comorbidities for which to screen routinely include smoking,¹⁵³ diabetes,^{39,40} metabolic syndrome,⁴¹ depression/anxiety,⁴⁴ follicular occlusion tetrad, and squamous cell carcinoma of HS-affected skin.¹⁷⁶ Thorough review of systems, smoking history, glycosylated hemoglobin type A1c and/or fasting glucose level in patients with signs and/or symptoms of diabetes, and periodic skin examination (particularly of chronic lesions on the perineum and buttocks, where squamous cell carcinoma is most common) are recommended.

A recent high-quality cross-sectional study of more than 40,000 patients⁴⁰ and meta-analysis of prior studies³⁹ suggest a 1.5- to 3-fold risk of type 2 diabetes in patients with HS, with a prevalence up to 30%. Patients with physical signs of diabetes, hypertension, obesity, and/or hyperlipidemia are at highest risk and should be screened. Similarly, a large-cross sectional

study demonstrated more than a 3-fold risk of polycystic ovarian syndrome, with up to 9% of this group affected.⁴⁷ Menstrual irregularity and/or physical signs of androgen excess should prompt further evaluation for polycystic ovarian syndrome.

Screening for hyperlipidemia and metabolic syndrome are supported by lower-level evidence.^{38,41} Additional large-scale cross-sectional and case-control studies of varying quality demonstrate an association of HS with acne,⁴³ inflammatory arthropathies,¹⁷⁷ sexual dysfunction,⁵¹ psychiatric conditions,^{44,178,179} lymphoma,³⁵ thyroid disease,³⁵ substance abuse,^{35,154,180} Down syndrome,^{52,53} pyoderma gangrenosum, inflammatory bowel disease,^{21,34,46,181-183} and autoinflammatory syndromes. Screening for these conditions is recommended when triggered by pertinent examination findings or review of systems (Table III).^{35-38,42,44,52}

LIFESTYLE FACTORS AND ALTERNATIVE TREATMENTS IN HS

Recommendations on lifestyle modifications are based on limited-quality evidence (Table IV). Approximately 70% to 75% of patients with HS smoke and 10% to 15% are past smokers.^{153,158,184,185} Some data suggest an association between smoking status and HS severity, duration, and failure of treatment response^{158,184,186}; however, other studies have not found an association with HS activity¹⁸⁷ or quality of life.¹⁸⁴ In 2 cases, women with HS stopped smoking and had complete remission.¹¹² Smoking cessation is recommended, as it potentially improves HS as well as other health outcomes.¹⁸⁸

The prevalence of being overweight or obese may be higher than 75% in patients with HS.^{132,154,187} Some data link higher body mass index and HS severity¹⁸⁷; however, another study was contradictory.^{153,187} Case reports and commentaries suggest that substantial weight loss may improve or resolve disease.^{123,125} Surveys of 35 patients with HS who underwent bariatric surgery at a single center found that 35% had a decrease in self-reported symptoms after surgery.¹²⁴ With more than a 15% weight reduction, 48.6% of patients reported complete remission, 20% reported improvement, and 20% reported no improvement.¹²⁴ Although there are limited data on effects of weight loss, screening for obesity is important for improving health outcomes.¹⁸⁹

The effects of specific dietary restrictions are unclear. Dairy avoidance was described in surveys of 47 patients, with 83% reporting some improvement and none reporting worsening, but response bias likely influenced the results.¹²² Avoidance of brewer's yeast (*Saccharomyces cerevisiae*) in addition to HS surgery was investigated in 12 subjects. All improved over 12 months and reported recurrence only after consuming brewer's yeast, but the effects of surgery confound the results.¹²¹

Zinc has been recommended for patients with Hurley stage I or II disease as a modulator of innate immunity.¹⁸⁵ A retrospective study of 54 patients with Hurley stage I or II disease who were treated with zinc gluconate, 90 mg daily, and topical triclosan 2% for 3 months demonstrated improvement in mean DLQI score ($P = .039$).¹¹⁸ Another prospective study of 22 patients receiving 90 mg daily reported improvement in all patients, with 8 complete responses and 14 partial responses.¹¹⁴ Guillet et al¹²⁰ found that of 22 vitamin D-deficient

patients with HS who received supplements to achieve normal levels, 63% achieved a 20% decrease in inflammatory nodules.¹²⁰ The evidence is insufficient to support routine use of vitamin D or zinc supplementation.

It has been hypothesized that friction may stimulate epidermal hyperplasia contributing to development of HS lesions, but the evidence is limited to patient surveys and anecdotes.^{126,127,129,130,185} Of 110 patients surveyed, 16% reported worsening from “tight clothing/friction” whereas 11% reported relief from “loose/cotton clothing/cleanliness/drying/cold.”¹²⁸ Overall, there is insufficient evidence supporting clothing recommendations.

Two studies investigated shaving and use of chemical depilatories, deodorants, and antiperspirants in HS.^{131,132} HS was not linked to daily shaving or use of depilatories, deodorants, or antiperspirants in 1 small study.¹³¹ In a separate chart review of 11 patients, 6 reported adverse reaction to antiperspirant or deodorant use around the time of HS onset, but the potential for recall bias is high.¹³² Weak evidence limits recommendations regarding this kind of personal care in HS.

SURGICAL MODALITIES IN HS

Recommendations for the surgical management of acute HS lesions relies on low-quality, uncontrolled, retrospective reports (Table V). In 2010, van der Zee et al described the deroofting technique, in which abscesses and associated sinuses are probed and the skin overlying the sinus or abscess cavity is removed stepwise with the base left untreated. In the uncontrolled study of 73 lesions, 17% recurred, but 90% patient satisfaction was achieved.¹⁰² In 2012, Van Hattem et al reviewed a variation using electrocautery to excise the overlying skin, with a 4% recurrence rate.¹⁰¹ No controlled, prospective studies exist, but deroofting appears to be effective for acute and chronic lesions, with utility in a variety of outpatient settings.^{7,84,101,102,190-192}

In contrast to deroofting, incision and drainage has been associated with recurrence rates approaching 100%, although it provides acute relief when other methods are not feasible.^{84,89,107,192,193} In general, deroofting small lesions with a punch tool or by other methods is preferred to simple drainage. For large nonrecurrent abscesses, incision and drainage procedures can provide acute relief and allow for a smaller definitive procedure to be performed at a future date once the inflammation and size of the affected tissue have been reduced. Electrocautery destruction using a loop electrode to remove lesions to the subcutaneous layer and cryosurgery for acute/subacute lesions have been characterized in few studies, with inadequate evidence to recommend use.^{81,106}

Moderate-quality evidence for surgical management of chronic lesions has consisted of uncontrolled, retrospective reports. In a series of 590 patients treated with excision, deroofting, or drainage, drainage was associated with the highest recurrence, whereas deroofting and wide excision were about equal in effectiveness. There was a 24.4% overall recurrence rate, with younger age and operation at multiple sites associated with increased risk.^{84,192} Another series of 31 patients treated with drainage, limited surgery, or radical

excision reported 100%, 42.8%, and 27% recurrence rates, respectively, with a mean follow-up of 72 months.¹⁹³ Carbon dioxide (CO₂) laser excision and marsupialization (laser vaporization of the wound base and edges to create a pocket-like defect with smooth, rounded edges) with secondary intention healing, in particular, seem to be associated with low recurrence rates, though they can have prolonged healing times.^{65,66}

Wide local excision has been the mainstay of traditional surgery and can result in a disease-free state where the excision was performed. Excision can typically be limited to a superficial subcutaneous plane, with deeper excision based on visible disease extension. Because surgery alone does not alter disease biology, understanding the trade-offs between extent of excision, surgical morbidity, and reducing the risk of future lesions is an important surgical judgment.

In addition to surgical technique, cure rates may depend on the location treated with perianal, vulvar, and inferior breast having higher recurrence rates.^{84,87,89,107,193} Reconstruction methods such as primary closure, grafts, and flaps can speed healing but may be associated with higher recurrence rates than secondary intention healing. Variation in surgical technique within and among studies makes recommendations regarding reconstruction methods uncertain.*

Excision with delayed closure following days to weeks of secondary intention healing has been frequently reported.^{86,93,95,141,195-199} This requires prolonged recoveries and can be complicated by infection, joint contractures, and scarring. Immediate reconstruction may allow faster healing, though recovery can still be prolonged. Grafts are generally split-thickness with a technique similar to that for treating large burns.²⁰⁰ Additional reports describe using “recycled skin” grafts^{145,201} or dermal scaffolds before grafting,^{97,99} though contour irregularities in reconstructed and donor sites are typical. Regional or free flaps provide thicker coverage with a more natural, less scar-like appearance, but they can be bulky and require thinning as a secondary procedure.^{81,96,98,107,110} Discussing the drawbacks and benefits of various forms of reconstruction with patients can help determine individualized approaches.

Surgical intervention is typically reserved for disease that is uncontrolled by pharmacologic care. When procedures are indicated, medical therapy may be initiated or continued without interruption, as risk for surgical complications is likely higher from poorly controlled disease than from medications.

PAIN MANAGEMENT IN HS

Pain is a significant independent contributor to quality of life in HS, and reducing inflammation improves pain.¹⁵⁰ There are no specific HS pain studies in the literature; treatment is based on pain guidelines, expert opinion, and patient preferences (Table VI).¹⁴⁹ Nociceptive, stimulant-dependent, and neuropathic pain all contribute, and psychologic comorbidities should be considered during management.²⁰³

*82-84,86-90,92,95,96,107,141,192-196

For management of acute pain, topical analgesics such as lidocaine, oral acetaminophen, and oral nonsteroidal anti-inflammatory drugs are preferred.²⁰³

A multidisciplinary approach to chronic pain management, at times in collaboration with pain specialists, is most effective. Because of the opioid crisis, use of opioids must be considered judiciously, but they are sometimes necessary.²⁰⁴ Tramadol should be considered as an alternative to conventional opioids in patients with cardiopulmonary compromise,²⁰⁵ and it permits a nonsteroidal anti-inflammatory drug-sparing effect. Codeine, hydrocodone, morphine, and other opioids can manage pain that does not respond to first-line agents.²⁰⁴ Anticonvulsants, including pregabalin and gabapentin, can improve neuropathic pain but should be used with caution.¹⁴⁹

WOUND CARE IN HS

Recommendations for postsurgical and nonsurgical HS wound care are based on limited evidence (Table VII).^{206,207}

Although there are studies on the use of absorptive dressings in HS, no data favor a specific type. Atraumatic and absorptive dressings are important, but they can be costly.²⁰⁸ Most data focus on postsurgical wounds with use of simple foam dressings, whereas advanced dressings are used for more complex wounds.

A prospective randomized study of 200 patients found lower complication rates in 124 treated with primary closure over a gentamycin-collagen sponge than in 76 treated with primary closure alone in the first month, though at 3 months the rates of recurrence and complications were similar.¹³³ Manuka honey with silver alginate dressings, hydrofiber dressings (Aquacel, ConvaTec, Deeside, United Kingdom), and silastic foam dressings have all been used in small series of postsurgical wounds with good patient satisfaction, but comparator groups have been lacking.^{134,135} An approach using platelet-rich plasma on a surgical wound bed and injected at the edges with Hyalomatrix PA dressing (Anika Therapeutics, Bedford, MA) has been reported in a single case with adequate healing.¹⁶³

Negative-pressure wound therapy has been shown to shorten the duration between excision and delayed closure or grafting, but comparisons of various approaches using negative-pressure wound therapy alone versus with silver dressings or dermal regeneration templates (Integra, Integra LifeSciences, Plainsboro, NJ) are limited.^{136,137,146}

LIGHT, LASER AND ENERGY SOURCES IN HS

A number of energy sources have been evaluated in HS (Table VIII). The neodymium-doped yttrium-aluminum-garnet laser has the largest number of controlled trials and case reports showing consistently effective results, though mostly at 1 center.⁵⁶⁻⁵⁸ Patients had mostly Hurley stage II or III disease. The entire affected body region is treated with the active nodules double-pulsed in a stacked fashion. In the randomized controlled trial, typical settings generally used a 10-mm spot size with a 10-ms pulse duration and 35 to 50 J/cm² in patients with Fitzpatrick skin type I to III and a 20-ms pulse duration and 25 to 40 J/cm² in patients with skin types IV to VI.⁵⁶ In general, settings may vary by specific device and

selected spot size and their use should be guided by operator experience with an end point of delayed post-treatment perifollicular erythema and/or edema for follicular destruction.²⁰⁹ In most studies, 3 or 4 treatment sessions were performed, though additional treatment to further reduce follicular units may provide more lasting benefit.

CO₂ lasers were the first to be used for HS, and they are used for excision, marsupialization, and vaporization of affected skin. A large number of uncontrolled retrospective series in patients with Hurley stage II or III disease show consistently positive outcomes.⁶¹⁻⁶⁷

Photodynamic therapy has been evaluated in several series. Variations in outcome measures, light sources, photosensitizers, and topical versus intralesional treatment make interpreting study results difficult. The results with topical sensitizers are equivocal, and intralesional photodynamic therapy offers promise based on only small, uncontrolled studies.^{70,71,210}

Use of long-pulsed alexandrite and diode lasers and intense pulsed light is supported by case reports, likely owing to follicular destruction and anti-inflammatory effects similar to those with the use of a neodymium-doped yttrium-aluminum-garnet laser.^{54,55,59,60,211} Electrosurgery and radiofrequency are ablative and supported only by case reports.^{80,81} Use of a fractionated CO₂ laser has been reported in cases to help with postsurgical scar contraction and delayed wound healing.^{69,78}

External beam radiation has been examined in many case reports. However, disease severity has not been stratified, results are equivocal, and no randomized controlled trials have been published.^{78,79} Appropriate use is limited to severe cases that were recalcitrant to most other treatment modalities and not suitable for excision.

CONCLUSION

HS management is often complex and requires balancing medical and surgical treatment options in addition to addressing associated pain, psychiatric, and medical comorbidities. These guidelines aim to help clinicians make optimal treatment decisions, but standard of care management requires an individualized approach because rigorous evidence is unavailable for most interventions. The need for stronger evidence highlighted by the guidelines should direct future research to fill gaps in current evidence.

Abbreviations used:

DLQI	Dermatology Life Quality Index
HS	hidradenitis suppurativa
IL	interleukin

REFERENCES

1. Miller I, Lynggaard CD, Lophaven S, Zachariae C, Dufour DN, Jemec GB. A double-blind placebo-controlled randomized trial of adalimumab in the treatment of hidradenitis suppurativa. *Br J Dermatol*. 2011;165(2):391–398. [PubMed: 21457202]

2. Kimball AB, Sobell JM, Zouboulis CC, et al. HiSCR (hidradenitis suppurativa clinical response): a novel clinical endpoint to evaluate therapeutic outcomes in patients with hidradenitis suppurativa from the placebo-controlled portion of a phase 2 adalimumab study. *J Eur Acad Dermatol Venereol*. 2016;30(6):989–994. [PubMed: 26201313]
3. Adams DR, Yankura JA, Fogelberg AC, Anderson BE. Treatment of hidradenitis suppurativa with etanercept injection. *Arch Dermatol*. 2010;146(5):501–504. [PubMed: 20479297]
4. Grant A, Gonzalez T, Montgomery MO, Cardenas V, Kerdel FA. Infliximab therapy for patients with moderate to severe hidradenitis suppurativa: a randomized, double-blind, placebo-controlled crossover trial. *J Am Acad Dermatol*. 2010;62(2):205–217. [PubMed: 20115947]
5. Jemec GB, Wendelboe P. Topical clindamycin versus systemic tetracycline in the treatment of hidradenitis suppurativa. *J Am Acad Dermatol*. 1998;39(6):971–974. [PubMed: 9843011]
6. Kimball AB, Sundaram M, Banderas B, Foley C, Shields AL. Development and initial psychometric evaluation of patient-reported outcome questionnaires to evaluate the symptoms and impact of hidradenitis suppurativa. *J Dermatolog Treat*. 2018;29(2):152–164. [PubMed: 28608738]
7. Zouboulis CC, Desai N, Emtestam L, et al. European S1 guideline for the treatment of hidradenitis suppurativa/acne inversa. *J Eur Acad Dermatol Venereol*. 2015;29(4):619–644. [PubMed: 25640693]
8. Ring HC, Bay L, Kallenbach K, et al. Normal skin microbiota is altered in pre-clinical hidradenitis suppurativa. *Acta Derm Venereol*. 2017;97(2):208–213. [PubMed: 27377144]
9. Hessam S, Sand M, Georgas D, Anders A, Bechara FG. Microbial profile and antimicrobial susceptibility of bacteria found in inflammatory hidradenitis suppurativa lesions. *Skin Pharmacol Physiol*. 2016;29(3):161–167. [PubMed: 27351708]
10. Katoulis AC, Koumaki D, Liakou AI, et al. Aerobic and anaerobic bacteriology of hidradenitis suppurativa: a study of 22 cases. *Skin Appendage Disord*. 2015;1(2):55–59. [PubMed: 27170935]
11. Jahns AC, Killasli H, Nosek D, et al. Microbiology of hidradenitis suppurativa (acne inversa): a histological study of 27 patients. *APMIS*. 2014;122(9):804–809. [PubMed: 24475943]
12. Ring HC, Emtestam L. The microbiology of hidradenitis suppurativa. *Dermatol Clin*. 2016;34(1):29–35. [PubMed: 26617355]
13. Maraki S, Evangelou G, Stafylaki D, Scoulica E. *Actinotignum schaalii* subcutaneous abscesses in a patient with hidradenitis suppurativa: case report and literature review. *Anaerobe*. 2017;43:43–46. [PubMed: 27913316]
14. Nedomansky J, Weiss D, Willinger B, Nickl S, Steininger C. Acne inversa complicated by *Actinomyces neuii*. *Infection*. 2016;44(2):247–249. [PubMed: 26129687]
15. Patnaik S, Mohanty I, Panda P, Sahu S, Dash M. Disseminated *Mycobacterium chelonae* infection: complicating a case of hidradenitis suppurativa. *Indian Dermatol Online J*. 2013;4(4):336–339. [PubMed: 24350020]
16. Blok JL, Li K, Brodmerkel C, Horvatovich P, Jonkman MF, Horvath B. Ustekinumab in hidradenitis suppurativa: clinical results and a search for potential biomarkers in serum. *Br J Dermatol*. 2016;174(4):839–846. [PubMed: 26641739]
17. Frew JW, Vekic DA, Woods J, Cains GD. A systematic review and critical evaluation of reported pathogenic sequence variants in hidradenitis suppurativa. *Br J Dermatol*. 2017;177(4):987–998. [PubMed: 28278367]
18. Giamarellos-Bourboulis EJ, Platzer M, Karagiannidis I, et al. High copy numbers of beta-defensin cluster on 8p23.1, confer genetic susceptibility, and modulate the physical course of hidradenitis suppurativa/acne inversa. *J Invest Dermatol*. 2016;136(8):1592–1598. [PubMed: 27164300]
19. Giatrakos S, Huse K, Kanni T, et al. Haplotypes of IL-12Rbeta1 impact on the clinical phenotype of hidradenitis suppurativa. *Cytokine*. 2013;62(2):297–301. [PubMed: 23557799]
20. Hessam S, Sand M, Gambichler T, Bechara FG. Correlation of inflammatory serum markers with disease severity in patients with hidradenitis suppurativa (HS). *J Am Acad Dermatol*. 2015;73(6):998–1005. [PubMed: 26410359]
21. Janse IC, Koldijk MJ, Spekhorst LM, et al. Identification of clinical and genetic parameters associated with hidradenitis suppurativa in inflammatory bowel disease. *Inflamm Bowel Dis*. 2016;22(1):106–113. [PubMed: 26422515]

22. Matusiak L, Bieniek A, Szepietowski JC. Soluble interleukin-2 receptor serum level is a useful marker of hidradenitis suppurativa clinical staging. *Biomarkers*. 2009;14(6):432–437. [PubMed: 19627253]
23. Matusiak L, Bieniek A, Szepietowski JC. Increased serum tumour necrosis factor-alpha in hidradenitis suppurativa patients: is there a basis for treatment with anti-tumour necrosis factor-alpha agents? *Acta Derm Venereol*. 2009;89(6):601–603. [PubMed: 19997690]
24. Matusiak L, Salomon J, Nowicka-Suszko D, Bieniek A, Szepietowski JC. Chitinase-3-like protein 1 (YKL-40): novel biomarker of hidradenitis suppurativa disease activity? *Acta Derm Venereol*. 2015;95(6):736–737. [PubMed: 25655759]
25. Matusiak L, Szczech J, Bieniek A, Nowicka-Suszko D, Szepietowski JC. Increased interleukin (IL)-17 serum levels in patients with hidradenitis suppurativa: implications for treatment with anti-IL-17 agents. *J Am Acad Dermatol*. 2017;76(4):670–675. [PubMed: 28041632]
26. Nassar D, Hugot JP, Wolkenstein P, Revuz J. Lack of association between *CARD15* gene polymorphisms and hidradenitis suppurativa: a pilot study. *Dermatology*. 2007;215(4):359. [PubMed: 17911997]
27. Montaudie H, Seitz-Polski B, Cornille A, Benzaken S, Lacour JP, Passeron T. Interleukin 6 and high-sensitivity C-reactive protein are potential predictive markers of response to infliximab in hidradenitis suppurativa. *J Am Acad Dermatol*. 2017;76(1):156–158. [PubMed: 27986139]
28. Savva A, Kanni T, Damoraki G, et al. Impact of Toll-like receptor-4 and tumour necrosis factor gene polymorphisms in patients with hidradenitis suppurativa. *Br J Dermatol*. 2013;168(2):311–317. [PubMed: 23106544]
29. Thomi R, Yerly D, Yawalkar N, Simon D, Schlapbach C, Hunger RE. Interleukin-32 is highly expressed in lesions of hidradenitis suppurativa. *Br J Dermatol*. 2017;177(5):1358–1366. [PubMed: 28301691]
30. van Rappard DC, Mekkes JR. Hidradenitis suppurativa not associated with *CARD15/NOD2* mutation: a case series. *Int J Dermatol*. 2014;53(1):e77–e79. [PubMed: 23488593]
31. Wieland CW, Vogl T, Ordelman A, et al. Myeloid marker S100A8/A9 and lymphocyte marker, soluble interleukin 2 receptor: biomarkers of hidradenitis suppurativa disease activity? *Br J Dermatol*. 2013;168(6):1252–1258. [PubMed: 23320892]
32. Wolk K, Wenzel J, Tsaousi A, et al. Lipocalin-2 is expressed by activated granulocytes and keratinocytes in affected skin and reflects disease activity in acne inversa/hidradenitis suppurativa. *Br J Dermatol*. 2017;177(5):1385–1393. [PubMed: 28256718]
33. Xu H, Xiao X, He Y, et al. Increased serum interleukin-6 levels in patients with hidradenitis suppurativa. *Postepy Dermatol Alergol*. 2017;34(1):82–84. [PubMed: 28261036]
34. Kohorst JJ, Kimball AB, Davis MD. Systemic associations of hidradenitis suppurativa. *J Am Acad Dermatol*. 2015;73(5 Suppl 1):S27–S35. [PubMed: 26470611]
35. Shlyankevich J, Chen AJ, Kim GE, Kimball AB. Hidradenitis suppurativa is a systemic disease with substantial comorbidity burden: a chart-verified case-control analysis. *J Am Acad Dermatol*. 2014;71(6):1144–1150. [PubMed: 25440440]
36. Tzellos T, Zouboulis CC, Gulliver W, Cohen AD, Wolkenstein P, Jemec GB. Cardiovascular disease risk factors in patients with hidradenitis suppurativa: a systematic review and meta-analysis of observational studies. *Br J Dermatol*. 2015;173(5):1142–1155. [PubMed: 26153913]
37. Fimmel S, Zouboulis CC. Comorbidities of hidradenitis suppurativa (acne inversa). *Dermatoendocrinol*. 2010;2(1):9–16. [PubMed: 21547142]
38. Miller IM, McAndrew RJ, Hamzavi I. Prevalence, risk factors, and comorbidities of hidradenitis suppurativa. *Dermatol Clin*. 2016;34(1):7–16. [PubMed: 26617352]
39. Bui TL, Silva-Hirschberg C, Torres J, Armstrong AW. Hidradenitis suppurativa and diabetes mellitus: a systematic review and meta-analysis. *J Am Acad Dermatol*. 2018;78(2):395–402. [PubMed: 29056237]
40. Garg A, Birabarahan M, Strunk A. Prevalence of type 2 diabetes mellitus among patients with hidradenitis suppurativa in the United States. *J Am Acad Dermatol*. 2018;79(1):71–76. [PubMed: 29339240]

41. Shalom G, Freud T, Harman-Boehm I, Polishchuk I, Cohen AD. Hidradenitis suppurativa and metabolic syndrome: a comparative cross-sectional study of 3207 patients. *Br J Dermatol*. 2015;173(2):464–470. [PubMed: 25760289]
42. Scheinfeld N Diseases associated with hidranitis suppurativa: part 2 of a series on hidradenitis. *Dermat Online J*. 2013;19(6):18558.
43. Wertenteil S, Strunk A, Garg A. Overall and subgroup prevalence of acne vulgaris among patients with hidradenitis suppurativa [e-pub ahead of print]. *J Am Acad Dermatol*. 2018. 10.1016/j.jaad.2018.09.040. Accessed October 18, 2018.
44. Shavit E, Dreier J, Freud T, Halevy S, Vinker S, Cohen AD. Psychiatric comorbidities in 3207 patients with hidradenitis suppurativa. *J Eur Acad Dermatol Venereol*. 2015;29(2):371–376. [PubMed: 24909646]
45. Pena ZG, Sivamani RK, Konia TH, Eisen DB. Squamous cell carcinoma in the setting of chronic hidradenitis suppurativa; report of a patient and update of the literature. *Dermat Online J*. 2015;21(4).
46. Shalom G, Freud T, Ben Yakov G, et al. Hidradenitis suppurativa and inflammatory bowel disease: a cross-sectional study of 3,207 patients. *J Invest Dermatol*. 2016;136(8):1716–1718. [PubMed: 27094593]
47. Garg A, Neuren E, Strunk A. Hidradenitis suppurativa is associated with polycystic ovary syndrome: a population-based analysis in the United States. *J Invest Dermatol*. 2018;138(6):1288–1292. [PubMed: 29378201]
48. Kraft JN, Searles GE. Hidradenitis suppurativa in 64 female patients: retrospective study comparing oral antibiotics and antiandrogen therapy. *J Cutan Med Surg*. 2007;11(4):125–131. [PubMed: 17601419]
49. Alavi A, Farzanfar D, Rogalska T, Lowes MA, Chavoshi S. Quality of life and sexual health in patients with hidradenitis suppurativa. *Int J Womens Dermatol*. 2018;4(2):74–79. [PubMed: 30023423]
50. Janse IC, Deckers IE, van der Maten AD, et al. Sexual health and quality of life are impaired in hidradenitis suppurativa: a multicentre cross-sectional study. *Br J Dermatol*. 2017;176(4):1042–1047. [PubMed: 27534591]
51. Slyper M, Strunk A, Garg A. Incidence of sexual dysfunction among patients with hidradenitis suppurativa: a population-based retrospective analysis. *Br J Dermatol*. 2018;179(2):502–503. [PubMed: 29478285]
52. Denny G, Anadkat MJ. Hidradenitis suppurativa (HS) and Down syndrome (DS): increased prevalence and a younger age of hidradenitis symptom onset. *J Am Acad Dermatol*. 2016;75(3):632–634. [PubMed: 27543219]
53. Garg A, Strunk A, Midura M, Papagermanos V, Pomerantz H. Prevalence of hidradenitis suppurativa among patients with Down syndrome: a population-based cross-sectional analysis. *Br J Dermatol*. 2018;178(3):697–703. [PubMed: 28662304]
54. Highton L, Chan WY, Khwaja N, Laitung JK. Treatment of hidradenitis suppurativa with intense pulsed light: a prospective study. *Plast Reconstr Surg*. 2011;128(2):459–465.
55. Piccolo D, Di Marcantonio D, Crisman G, et al. Unconventional use of intense pulsed light. *Biomed Res Int*. 2014;2014:618206. [PubMed: 25276803]
56. Tierney E, Mahmoud BH, Hexsel C, Ozog D, Hamzavi I. Randomized control trial for the treatment of hidradenitis suppurativa with a neodymium-doped yttrium aluminium garnet laser. *Dermatol Surg*. 2009;35(8):1188–1198. [PubMed: 19438670]
57. Mahmoud BH, Tierney E, Hexsel CL, Pui J, Ozog DM, Hamzavi IH. Prospective controlled clinical and histopathologic study of hidradenitis suppurativa treated with the long-pulsed neodymium:yttrium-aluminium-garnet laser. *J Am Acad Dermatol*. 2010;62(4):637–645. [PubMed: 20227579]
58. Xu LY, Wright DR, Mahmoud BH, Ozog DM, Mehregan DA, Hamzavi IH. Histopathologic study of hidradenitis suppurativa following long-pulsed 1064-nm Nd:YAG laser treatment. *Arch Dermatol*. 2011;147(1):21–28. [PubMed: 20855672]

59. Koch D, Pratsou P, Szczecinska W, Lanigan S, Abdullah A. The diverse application of laser hair removal therapy: a tertiary laser unit's experience with less common indications and a literature overview. *Laser Med Sci.* 2015;30(1):453–467.
60. Downs A Smoothbeam laser treatment may help improve hidradenitis suppurativa but not Hailey-Hailey disease. *J Cosmet Laser Ther.* 2004;6(3):163–164. [PubMed: 15545102]
61. Dalrymple JC, Monaghan JM. Treatment of hidradenitis suppurativa with the carbon dioxide laser. *Br J Surg.* 1987;74(5):420. [PubMed: 3109537]
62. Lapins J, Marcusson JA, Emtestam L. Surgical treatment of chronic hidradenitis suppurativa: CO₂ laser stripping-secondary intention technique. *Br J Dermatol.* 1994;131(4):551–556. [PubMed: 7947209]
63. Finley EM, Ratz JL. Treatment of hidradenitis suppurativa with carbon dioxide laser excision and second-intention healing. *J Am Acad Dermatol.* 1996;34(3):465–469. [PubMed: 8609261]
64. Madan V, Hindle E, Hussain W, August PJ. Outcomes of treatment of nine cases of recalcitrant severe hidradenitis suppurativa with carbon dioxide laser. *Br J Dermatol.* 2008;159(6):1309–1314. [PubMed: 19036028]
65. Hazen PG, Hazen BP. Hidradenitis suppurativa: successful treatment using carbon dioxide laser excision and marsupialization. *Dermatol Surg.* 2010;36(2):208–213. [PubMed: 20039918]
66. Mikkelsen PR, Dufour DN, Zarchi K, Jemec GB. Recurrence rate and patient satisfaction of CO₂ laser evaporation of lesions in patients with hidradenitis suppurativa: a retrospective study. *Dermatol Surg.* 2015;41(2):255–260. [PubMed: 25654196]
67. Lapins J, Sartorius K, Emtestam L. Scanner-assisted carbon dioxide laser surgery: a retrospective follow-up study of patients with hidradenitis suppurativa. *J Am Acad Dermatol.* 2002;47(2):280–285. [PubMed: 12140476]
68. Krakowski AC, Diaz L, Admani S, Uebelhoer NS, Shumaker PR. Healing of chronic wounds with adjunctive ablative fractional laser resurfacing in two pediatric patients. *Lasers Surg Med.* 2016;48(2):166–169. [PubMed: 26251161]
69. Nicholson CL, Hamzavi I, Ozog DM. Rapid healing of chronic ulcerations and improvement in range of motion after fractional carbon dioxide (CO₂) treatment after CO₂ excision of hidradenitis suppurativa axillary lesions: a case report. *JAAD Case Reps.* 2016;2(1):4–6.
70. Passeron T, Khemis A, Ortonne JP. Pulsed dye laser-mediated photodynamic therapy for acne inversa is not successful: a pilot study on four cases. *J Dermatolog Treat.* 2009;20(5):297–298. [PubMed: 19370441]
71. Strauss RM, Pollock B, Stables GI, Goulden V, Cunliffe WJ. Photodynamic therapy using aminolaevulinic acid does not lead to clinical improvement in hidradenitis suppurativa. *Br J Dermatol.* 2005;152(4):803–804. [PubMed: 15840120]
72. Valladares-Narganes LM, Rodriguez-Prieto MA, Blanco-Suarez MD, Rodriguez-Lage C, Garcia-Doval I. Treatment of hidradenitis suppurativa with intralesional photodynamic therapy using a laser diode attached to an optical cable: a promising new approach. *Br J Dermatol.* 2015;172(4):1136–1139. [PubMed: 25196140]
73. Gold M, Bridges TM, Bradshaw VL, Boring M. ALA-PDT and blue light therapy for hidradenitis suppurativa. *J Drugs Dermatol.* 2004;3(1 Suppl):S32–35. [PubMed: 14964759]
74. Gold MH. Aminolevulinic acid photodynamic therapy for hidradenitis suppurativa. *Dermatol Clin.* 2007;25(1):67–73. [PubMed: 17126743]
75. Schweiger ES, Riddle CC, Aires DJ. Treatment of hidradenitis suppurativa by photodynamic therapy with aminolevulinic acid: preliminary results. *J Drugs Dermatol.* 2011;10(4):381–386. [PubMed: 21455548]
76. Agut-Busquet E, Romani J, Gilaberte Y, Garcia-Malini A, Ribera-Pibernat M, Luelmo J. Photodynamic therapy with intralesional methylene blue and a 635 nm light-emitting diode lamp in hidradenitis suppurativa: a retrospective follow-up study in 7 patients and a review of the literature. *Photochem Photobiol Sci.* 2016;15(8):1020–1028. [PubMed: 27417568]
77. Fadel MA, Tawfik AA. New topical photodynamic therapy for treatment of hidradenitis suppurativa using methylene blue niosomal gel: a single-blind, randomized, comparative study. *Clin Exper Dermatol.* 2015;40(2):116–122. [PubMed: 25262788]

78. Trombetta M, Werts ED, Parda D. The role of radiotherapy in the treatment of hidradenitis suppurativa: case report and review of the literature. *Dermat Online J*. 2010;16(2):16.
79. Frohlich D, Baaske D, Glatzel M. [Radiotherapy of hidradenitis suppurativa--still valid today?]. *Strahlenther Onkol*. 2000;176(6):286–289. [PubMed: 10897256]
80. Iwasaki J, Marra DE, Fincher EF, Moy RL. Treatment of hidradenitis suppurativa with a nonablative radiofrequency device. *Dermatol Surg*. 2008;34(1):114–117. [PubMed: 18053033]
81. Aksakal AB, Adisen E. Hidradenitis suppurativa: importance of early treatment; efficient treatment with electrosurgery. *Dermatol Surg*. 2008;34(2):228–231. [PubMed: 18093196]
82. Wollina U, Langner D, Heinig B, Nowak A. Comorbidities, treatment, and outcome in severe anogenital inverse acne (hidradenitis suppurativa): a 15-year single center report. *IntJ Dermatol*. 2017;56(1):109–115. [PubMed: 27495143]
83. Posch C, Monshi B, Quint T, Vujic I, Lilgenau N, Rappersberger K. The role of wide local excision for the treatment of severe hidradenitis suppurativa (Hurley grade III): retrospective analysis of 74 patients. *J Am Acad Dermatol*. 2017;77(1):123–129.e125. [PubMed: 28377030]
84. Kohorst JJ, Baum CL, Otley CC, et al. Surgical management of hidradenitis suppurativa: outcomes of 590 consecutive patients. *Dermatol Surg*. 2016;42(9):1030–1040. [PubMed: 27340739]
85. Kohorst JJ, Hagen C, Baum CL, Davis MD. Treatment experience in a local population with hidradenitis suppurativa. *J Drugs Dermatol*. 2014;13(7):827–831. [PubMed: 25007366]
86. Alharbi Z, Kauczok J, Pallua N. A review of wide surgical excision of hidradenitis suppurativa. *BMC Dermatol*. 2012;12:9. [PubMed: 22734714]
87. Ellis LZ. Hidradenitis suppurativa: surgical and other management techniques. *Dermatol Surg*. 2012;38(4):517–536. [PubMed: 22092698]
88. Humphries LS, Kueberuwa E, Beederman M, Gottlieb LJ. Wide excision and healing by secondary intent for the surgical treatment of hidradenitis suppurativa: a single-center experience. *J Plast Reconstr Aesthet Surg*. 2016;69(4):554–566. [PubMed: 26785708]
89. Mehdizadeh A, Hazen PG, Bechara FG, et al. Recurrence of hidradenitis suppurativa after surgical management: a systematic review and meta-analysis. *J Am Acad Dermatol*. 2015;73(5 Suppl 1):S70–S77. [PubMed: 26470621]
90. Bieniek A, Matusiak L, Chlebicka I, Szepietowski JC. Secondary intention healing in skin surgery: our own experience and expanded indications in hidradenitis suppurativa, rhinophyma and non-melanoma skin cancers. *J Eur Acad Dermatol Venereol*. 2013;27(8):1015–1021. [PubMed: 22817107]
91. Wollina U, Tilp M, Meseg A, Schonlebe J, Heinig B, Nowak A. Management of severe anogenital acne inversa (hidradenitis suppurativa). *Dermatol Surg*. 2012;38(1):110–117. [PubMed: 22092781]
92. Bocchini SF, Habr-Gama A, Kiss DR, Imperiale AR, Araujo SE. Gluteal and perianal hidradenitis suppurativa: surgical treatment by wide excision. *Dis Colon Rectum*. 2003;46(7):944–949. [PubMed: 12847371]
93. Chen YE, Gerstle T, Verma K, Treiser MD, Kimball AB, Orgill DP. Management of hidradenitis suppurativa wounds with an internal vacuum-assisted closure device. *Plast Reconstr Surg*. 2014;133(3):370e–377e.
94. Chen ML, Odom B, Santucci RA. Surgical management of genitoperineal hidradenitis suppurativa in men. *Urology*. 2014;83(6):1412–1417. [PubMed: 24685061]
95. Mandal A, Watson J. Experience with different treatment modules in hidradenitis suppurativa: a study of 106 cases. *Surgeon*. 2005;3(1):23–26. [PubMed: 15789789]
96. Bohn J, Svensson H. Surgical treatment of hidradenitis suppurativa. *Scand J Plast Reconstr Surg Hand Surg*. 2001;35(3):305–309. [PubMed: 11680401]
97. Wormald JC, Balzano A, Clibbon JJ, Figus A. Surgical treatment of severe hidradenitis suppurativa of the axilla: thoracodorsal artery perforator (TDAP) flap versus split skin graft. *J Plast Reconstr Aesthet Surg*. 2014;67(8):1118–1124. [PubMed: 24933237]
98. Kishi K, Nakajima H, Imanishi N, Nakajima T. Extended split superior gluteus maximus musculocutaneous flap and reconstruction after resection of perianal and lower gluteal hidradenitis suppurativa. *J Plast Reconstr Aesthet Surg*. 2009;62(8):1081–1086. [PubMed: 18555002]
99. Melkun ET, Few JW. The use of biosynthetic skin substitute (Biobrane) for axillary reconstruction after surgical excision for hidradenitis suppurativa. *Plast Reconstr Surg*. 2005;115(5):1385–1388.

100. Rambhatla PV, Lim HW, Hamzavi I. A systematic review of treatments for hidradenitis suppurativa. *Arch Dermatol*. 2012;148(4):439–446. [PubMed: 22184715]
101. van Hattem S, Spoo JR, Horvath B, Jonkman MF, Leeman FW. Surgical treatment of sinuses by deroofting in hidradenitis suppurativa. *Dermatol Surg*. 2012;38(3):494–497. [PubMed: 22211359]
102. van der Zee HH, Prens EP, Boer J. Deroofing: a tissue-saving surgical technique for the treatment of mild to moderate hidradenitis suppurativa lesions. *J Am Acad Dermatol*. 2010;63(3):475–480. [PubMed: 20708472]
103. Crocco EI, Dalapicola MC, Suzuki NM, Alves RO. Surgical treatment of chronic hidradenitis suppurativa: CO₂ laser stripping-second intention technique. *Dermatol Surg*. 2016;42(3):429–431. [PubMed: 26866288]
104. Blok JL, Spoo JR, Leeman FW, Jonkman MF, Horvath B. Skin-tissue-sparing excision with electrosurgical peeling (STEEP): a surgical treatment option for severe hidradenitis suppurativa Hurley stage II/III. *J Eur Acad Dermatol Venereol*. 2015;29(2):379–382. [PubMed: 24460855]
105. Pagliarello C, Fabrizi G, Feliciani C, Di Nuzzo S. Cryoinsufflation for Hurley stage II hidradenitis suppurativa: a useful treatment option when systemic therapies should be avoided. *JAMA Dermatol*. 2014;150(7):765–766. [PubMed: 24806911]
106. Bong JL, Shalders K, Saihan E. Treatment of persistent painful nodules of hidradenitis suppurativa with cryotherapy. *Clin Exper Dermatol*. 2003;28(3):241–244. [PubMed: 12780702]
107. Janse I, Bieniek A, Horvath B, Matusiak L. Surgical procedures in hidradenitis suppurativa. *Dermatol Clin*. 2016;34(1):97–109. [PubMed: 26617363]
108. Haoxiang X, Chengrang L, Baoxi W, Xinfeng W. Modified abscess drainage in treatment of eight cases with hidradenitis suppurativa in China. *Dermatol Surg*. 2013;39(5):779–783. [PubMed: 23379443]
109. Zouboulis CC, van der Zee H, Teixeira HD, et al. Adalimumab treatment is associated with a trend toward reduced need for acute surgical interventions in patients with moderate-to-severe hidradenitis suppurativa [abstract]. Abstract 056. *J Invest Dermatol*. 2015;135(510).
110. Van Rappard DC, Mekkes JR. Treatment of severe hidradenitis suppurativa with infliximab in combination with surgical interventions. *Br J Dermatol*. 2012;167(1):206–208. [PubMed: 22229974]
111. Rayner CR. Pathogenesis, clinical features and management of hidradenitis suppurativa. *Ann R Coll Surg Engl*. 1997;79(4):309.
112. Simonart T Hidradenitis suppurativa and smoking. *J Am Acad Dermatol*. 2010;62(1):149–150. [PubMed: 20082894]
113. Alhusayen R, Shear NH. Scientific evidence for the use of current traditional systemic therapies in patients with hidradenitis suppurativa. *J Am Acad Dermatol*. 2015;73(5 Suppl 1):S42–S46. [PubMed: 26470615]
114. Brocard A, Knol AC, Khammari A, Dreno B. Hidradenitis suppurativa and zinc: a new therapeutic approach. A pilot study. *Dermatology*. 2007;214(4):325–327. [PubMed: 17460404]
115. Brocard A, Dreno B. Innate immunity: a crucial target for zinc in the treatment of inflammatory dermatosis. *J Eur Acad Dermatol Venereol*. 2011;25(10):1146–1152. [PubMed: 21261748]
116. Dreno B, Khammari A, Brocard A, et al. Hidradenitis suppurativa: the role of deficient cutaneous innate immunity. *Arch Dermatol*. 2012;148(2):182–186. [PubMed: 22004878]
117. Gupta M, Mahajan VK, Mehta KS, Chauhan PS. Zinc therapy in dermatology: a review. *Dermatol Res Pract*. 2014;2014:709152. [PubMed: 25120566]
118. Hessam S, Sand M, Meier NM, Gambichler T, Scholl L, Bechara FG. Combination of oral zinc gluconate and topical triclosan: an anti-inflammatory treatment modality for initial hidradenitis suppurativa. *J Dermatol Sci*. 2016;84(2):197–202. [PubMed: 27554338]
119. Scheinfeld N Hidradenitis suppurativa: a practical review of possible medical treatments based on over 350 hidradenitis patients. *Dermat Online J*. 2013;19(4):1.
120. Guillet A, Brocard A, Bach Ngohou K, et al. Verneuil’s disease, innate immunity and vitamin D: a pilot study. *J Eur Acad Dermatol Venereol*. 2015;29(7):1347–1353. [PubMed: 25512084]
121. Cannistra C, Finocchi V, Trivisonno A, Tambasco D. New perspectives in the treatment of hidradenitis suppurativa: surgery and brewer’s yeast-exclusion diet. *Surgery*. 2013;154(5):1126–1130. [PubMed: 23891479]

122. Danby FW. Diet in the prevention of hidradenitis suppurativa (acne inversa). *J Am Acad Dermatol*. 2015;73(5 Suppl 1):S52–S54. [PubMed: 26470617]
123. Boer J Resolution of hidradenitis suppurativa after weight loss by dietary measures, especially on frictional locations. *J Eur Acad Dermatol Venereol*. 2016;30(5):895–896. [PubMed: 25731202]
124. Kromann CB, Ibler KS, Kristiansen VB, Jemec GB. The influence of body weight on the prevalence and severity of hidradenitis suppurativa. *Acta Derm Venereol*. 2014;94(5):553–557. [PubMed: 24577555]
125. Thomas CL, Gordon KD, Mortimer PS. Rapid resolution of hidradenitis suppurativa after bariatric surgical intervention. *Clin Exper Dermatol*. 2014;39(3):315–317. quiz 317-318. [PubMed: 24635068]
126. Boer J, Mihajlovic D. Boils at frictional locations in a patient with hidradenitis suppurativa. *Acta Dermatovenerol Croat*. 2016;24(4):303–304. [PubMed: 28128084]
127. Dufour DN, Bryld LE, Jemec GB. Hidradenitis suppurativa complicating naevus comedonicus: the possible influence of mechanical stress on the development of hidradenitis suppurativa. *Dermatology*. 2010;220(4):323–325. [PubMed: 20389029]
128. von der Werth JM, Williams HC. The natural history of hidradenitis suppurativa. *J Eur Acad Dermatol Venereol*. 2000;14(5):389–392. [PubMed: 11305381]
129. de Winter K, van der Zee HH, Prens EP. Is mechanical stress an important pathogenic factor in hidradenitis suppurativa? *Exp Dermatol*. 2012;21(3):176–177. [PubMed: 22379963]
130. Bettoli V, Toni G, Ricci M, Zauli S, Virgili A. Hidradenitis suppurativa-acne inversa-like lesions complicating naevus comedonicus: second case supporting the mechanical stress as a triggering factor. *G Ital Dermatol Venereol*. 2016;151(3):306–307. [PubMed: 27176082]
131. Morgan WP, Leicester G. The role of depilation and deodorants in hidradenitis suppurativa. *Arch Dermatol*. 1982;118(2):101–102. [PubMed: 7059208]
132. Edlich RF, Silloway KA, Rodeheaver GT, Cooper PH. Epidemiology, pathology, and treatment of axillary hidradenitis suppurativa. *J Emerg Med*. 1986;4(5):369–378. [PubMed: 3805693]
133. Buimer MG, Ankersmit MF, Wobbles T, Klinkenbijl JH. Surgical treatment of hidradenitis suppurativa with gentamicin sulfate: a prospective randomized study. *Dermatol Surg*. 2008;34(2):224–227. [PubMed: 18093197]
134. Cooper RA, Molan PC, Krishnamoorthy L, Harding KG. Manuka honey used to heal a recalcitrant surgical wound. *Eur J Clin Microbiol Infect Dis*. 2001;20(10):758–759. [PubMed: 11757984]
135. Topley B, Brain S. Hidradenitis suppurativa: a case study. *Br J Nurs*. 2013;22(15):S16. S18-20.
136. Gonzaga TA, Endorf FW, Mohr WJ, Ahrenholz DH. Novel surgical approach for axillary hidradenitis suppurativa using a bilayer dermal regeneration template: a retrospective case study. *J Burn Care Res*. 2013;34(1):51–57. [PubMed: 23128139]
137. Pearce FB Jr, Richardson KA. Negative pressure wound therapy, staged excision and definitive closure with split-thickness skin graft for axillary hidradenitis suppurativa: a retrospective study. *J Wound Care*. 2017;26(Sup1):S36–S42.
138. Elwood ET, Bolitho DG. Negative-pressure dressings in the treatment of hidradenitis suppurativa. *Ann Plast Surg*. 2001;46(1):49–51. [PubMed: 11192034]
139. Hynes PJ, Earley MJ, Lawlor D. Split-thickness skin grafts and negative-pressure dressings in the treatment of axillary hidradenitis suppurativa. *Br J Plast Surg*. 2002;55(6):507–509.
140. Walls B, Mohammad S, Campbell J, Archer L, Beale J. Negative pressure dressings for severe hidradenitis suppurativa (acne inversa): a case report. *J Wound Care*. 2010;19(10):457–460. [PubMed: 20948495]
141. Chen E, Friedman HI. Management of regional hidradenitis suppurativa with vacuum-assisted closure and split thickness skin grafts. *Ann Plast Surg*. 2011;67(4):397–401. [PubMed: 21587057]
142. Jianbing T, Biao C, Qin L, Yanhong W. Topical negative pressure coupled with split-thickness skin grafting for the treatment of hidradenitis suppurativa: a case report. *Int Wound J*. 2015;12(3):334–337. [PubMed: 23834292]

143. Parrado R, Cadena M, Vergara A, Cadena D, Chalela JG. The role of negative pressure wound therapy in the management of hidradenitis suppurativa: a case report and literature review. *Int Wound J.* 2017;14(1):35–39. [PubMed: 26663439]
144. Rhode JM, Burke WM, Cederna PS, Haefner HK. Outcomes of surgical management of stage III vulvar hidradenitis suppurativa. *J Reprod Med.* 2008;53(6):420–428. [PubMed: 18664060]
145. Kinoshita-Ise M, Nakamura Y, Kumagai Y, Kubo A, Nagao K, Funakoshi T. Successful treatment of widespread chronic gluteal hidradenitis suppurativa with combination of recycled skin graft and negative-pressure wound therapy. *J Dermatol.* 2017;44(8):973–975. [PubMed: 27651126]
146. Nicoli F, Balzani A, Lazzeri D, et al. Severe hidradenitis suppurativa treatment using platelet-rich plasma gel and Hyalomatrix. *Int Wound J.* 2015;12(3):338–343. [PubMed: 23834343]
147. Vossen AR, van der Zee HH, Prens EP. Accelerated wound healing after wide excisions in hidradenitis suppurativa using autologous split-thickness skin grafting and platelet-rich plasma. *Int Wound J.* 2017;14(3):583–586. [PubMed: 27611792]
148. Morgan WP, Harding KG, Richardson G, Hughes LE. The use of silastic foam dressing in the treatment of advanced hidradenitis suppurativa. *Br J Surg.* 1980;67(4):277–280. [PubMed: 7388312]
149. Smith HS, Chao JD, Teitelbaum J. Painful hidradenitis suppurativa. *Clin J Pain.* 2010;26(5):435–444. [PubMed: 20473053]
150. Kimball AB, Okun MM, Williams DA, et al. Two phase 3 trials of adalimumab for hidradenitis suppurativa. *N Engl J Med.* 2016;375(5):422–434. [PubMed: 27518661]
151. Enamandram M, Rathmell JP, Kimball AB. Chronic pain management in dermatology: pharmacotherapy and therapeutic monitoring with opioid analgesia. *J Am Acad Dermatol.* 2015;73(4):575–582. quiz 583-574. [PubMed: 26369841]
152. Ebell MH, Siwek J, Weiss BD, et al. Strength of recommendation taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. *Am Fam Physician.* 2004;69(3):548–556. [PubMed: 14971837]
153. Vazquez BG, Alikhan A, Weaver AL, Wetter DA, Davis MD. Incidence of hidradenitis suppurativa and associated factors: a population-based study of Olmsted County, Minnesota. *J Invest Dermatol.* 2013;133(1):97–103. [PubMed: 22931916]
154. Revuz JE, Canoui-Poitrine F, Wolkenstein P, et al. Prevalence and factors associated with hidradenitis suppurativa: results from two case-control studies. *J Am Acad Dermatol.* 2008;59(4):596–601. [PubMed: 18674845]
155. Jemec GB, Kimball AB. Hidradenitis suppurativa: epidemiology and scope of the problem. *J Am Acad Dermatol.* 2015;73(5 Suppl 1):S4–S7. [PubMed: 26470614]
156. Garg A, Lavian J, Lin G, Strunk A, Alloo A. Incidence of hidradenitis suppurativa in the United States: a sex- and age-adjusted population analysis. *J Am Acad Dermatol.* 2017;77(1):118–122. [PubMed: 28285782]
157. Ingram JR, Jenkins-Jones S, Knipe DW, Morgan CLI, Cannings-John R, Piguat V. Population-based Clinical Practice Research Datalink study using algorithm modelling to identify the true burden of hidradenitis suppurativa. *Br J Dermatol.* 2018;178(4):917–924. [PubMed: 29094346]
158. Schrader AM, Deckers IE, van der Zee HH, Boer J, Prens EP. Hidradenitis suppurativa: a retrospective study of 846 Dutch patients to identify factors associated with disease severity. *J Am Acad Dermatol.* 2014;71(3):460–467. [PubMed: 24880664]
159. Reeder VJ, Mahan MG, Hamzavi IH. Ethnicity and hidradenitis suppurativa. *J Invest Dermatol.* 2014;134(11):2842–2843. [PubMed: 24820891]
160. Vaidya T, Vangipuram R, Alikhan A. Examining the race-specific prevalence of hidradenitis suppurativa at a large academic center; results from a retrospective chart review. *Dermat Online J.* 2017;23(6).
161. Vlassova N, Kuhn D, Okoye GA. Hidradenitis suppurativa disproportionately affects African Americans: a single-center retrospective analysis. *Acta Derm Venereol.* 2015;95(8):990–991. [PubMed: 26073615]
162. Deckers IE, Janse IC, van der Zee HH, et al. Hidradenitis suppurativa (HS) is associated with low socioeconomic status (SES): a cross-sectional reference study. *J Am Acad Dermatol.* 2016;75(4):755–759.e751. [PubMed: 27453539]

163. Wertenteil S, Strunk A, Garg A. Association of low socioeconomic status with hidradenitis suppurativa in the United States. *JAMA Dermatol.* 2018;54(9):1086–1088.
164. Gooderham M, Papp K. The psychosocial impact of hidradenitis suppurativa. *J Am Acad Dermatol.* 2015;73(5 Suppl 1):S19–S22. [PubMed: 26470609]
165. Kirby JS, Miller JJ, Adams DR, Leslie D. Health care utilization patterns and costs for patients with hidradenitis suppurativa. *JAMA Dermatol.* 2014;150(9):937–944. [PubMed: 24908260]
166. Kelly G, Prens EP. Inflammatory mechanisms in hidradenitis suppurativa. *Dermatol Clin.* 2016;34(1):51–58. [PubMed: 26617358]
167. Hoffman LK, Ghias MH, Lowes MA. Pathophysiology of hidradenitis suppurativa. *Semin Cutan Med Surg.* 2017;36(2):47–54. [PubMed: 28538743]
168. Napolitano M, Megna M, Timoshchuk EA, et al. Hidradenitis suppurativa: from pathogenesis to diagnosis and treatment. *Clin Cosmet Investig Dermatol.* 2017;10:105–115.
169. Ingram JR, Woo PN, Chua SL, et al. Interventions for hidradenitis suppurativa: a Cochrane systematic review incorporating GRADE assessment of evidence quality. *Br J Dermatol.* 2016;174(5):970–978. [PubMed: 26801356]
170. Hurley H Axillary hyperhidrosis, apocrine bromhidrosis, hidradenitis suppurativa, and familial benign pemphigus: surgical approach. In: Roenigk RK, Roenigk HK Jr, eds. *Dermatologic Surgery.* New York: Marcel Dekker; 1989:729–739.
171. Thorlacius L, Garg A, Ingram JR, et al. Towards global consensus on core outcomes for hidradenitis suppurativa research: an update from the HISTORIC consensus meetings I and II. *Br J Dermatol.* 2018;178(3):715–721. [PubMed: 29080368]
172. Ring HC, Thorsen J, Saunte DM, et al. The follicular skin microbiome in patients with hidradenitis suppurativa and healthy controls. *JAMA Dermatol.* 2017;153(9):897–905. [PubMed: 28538949]
173. Guet-Revillet H, Jais JP, Ungeheuer MN, et al. The microbiological landscape of anaerobic infections in hidradenitis suppurativa: a prospective metagenomic study. *Clin Infect Dis.* 2017;65(2):282–291. [PubMed: 28379372]
174. Ring HC, Bay L, Nilsson M, et al. Bacterial biofilm in chronic lesions of hidradenitis suppurativa. *Br J Dermatol.* 2017;176(4):993–1000. [PubMed: 27564400]
175. Tsaousi A, Witte E, Witte K, et al. MMP8 is increased in lesions and blood of acne inversa patients: a potential link to skin destruction and metabolic alterations. *Mediators Inflamm.* 2016;2016:4097574. [PubMed: 27843200]
176. Makris GM, Poulakaki N, Papanota AM, Kotsifa E, Sergeantanis TN, Psaltopoulou T. Vulvar, perianal and perineal cancer after hidradenitis suppurativa: a systematic review and pooled analysis. *Dermatol Surg.* 2017;43(1):107–115. [PubMed: 27755170]
177. Richette P, Molto A, Viguier M, et al. Hidradenitis suppurativa associated with spondyloarthritis – results from a multicenter national prospective study. *J Rheumatol.* 2014;41(3):490–494. [PubMed: 24429166]
178. Huilaja L, Tiri H, Jokelainen J, Timonen M, Tasanen K. Patients with hidradenitis suppurativa have a high psychiatric disease burden: a Finnish nationwide registry study. *J Invest Dermatol.* 2018;138(1):46–51. [PubMed: 28736236]
179. Tiri H, Jokelainen J, Timonen M, Tasanen K, Huilaja L. Somatic and psychiatric comorbidities of hidradenitis suppurativa in children and adolescents. *J Am Acad Dermatol.* 2018;79(3):514–519. [PubMed: 29518461]
180. Garg A, Papagermanos V, Midura M, Strunk A, Merson J. Opioid, alcohol, and cannabis misuse among patients with hidradenitis suppurativa: a population-based analysis in the United States. *J Am Acad Dermatol.* 2018;79(3):495–500.e491. [PubMed: 29499293]
181. Cices A, Ibler E, Majewski S, et al. Hidradenitis suppurativa association at the time of, or subsequent to, diagnosis of inflammatory bowel disease in a large U.S. patient population. *J Eur Acad Dermatol Venereol.* 2017;31(7):e311–e312. [PubMed: 28000245]
182. Lukach AJ, Saul MI, Ferris LK, Swoger JM. Risk factors for hidradenitis suppurativa in patients with inflammatory bowel disease. *Dig Dis Sci.* 2018;63(3):755–760. [PubMed: 29357084]

183. Garg A, Hundal J, Strunk A. Overall and subgroup prevalence of crohn disease among patients with hidradenitis suppurativa: a population-based analysis in the United States. *JAMA Dermatol.* 2018;154(7):814–818. [PubMed: 29800049]
184. Sartorius K, Emtestam L, Jemec GB, Lapins J. Objective scoring of hidradenitis suppurativa reflecting the role of tobacco smoking and obesity. *Br J Dermatol.* 2009;161(4):831–839. [PubMed: 19438453]
185. Zouboulis CC, Bechara FG, Fritz K, et al. [S1 guideline for the treatment of hidradenitis suppurativa/acne inversa * (number ICD-10 L73.2)]. *J Dtsch Dermatol Ges.* 2012;10(Suppl 5):S1–S31.
186. Garg A, Papagermanos V, Midura M, Strunk A. Incidence of hidradenitis suppurativa among tobacco smokers: a population-based retrospective analysis in the U.S.A. *Br J Dermatol.* 2018;178(3):709–714. [PubMed: 28960235]
187. Canoui-Poitrine F, Revuz JE, Wolkenstein P, et al. Clinical characteristics of a series of 302 French patients with hidradenitis suppurativa, with an analysis of factors associated with disease severity. *J Am Acad Dermatol.* 2009;61(1):51–57. [PubMed: 19406505]
188. Patnode CD, Henderson JT, Thompson JH, Senger CA, Fortmann SP, Whitlock EP. Behavioral counseling and pharmacotherapy interventions for tobacco cessation in adults, including pregnant women: a review of reviews for the U.S. Preventive Services Task Force. *Ann Intern Med.* 2015;163(8):608–621. [PubMed: 26389650]
189. LeBlanc E, O'Connor E, Whitlock EP, Patnode C, Kapka T. Screening for and Management of Obesity and Overweight in Adults. Evidence Report No. 89. AHRQ Publication No. 11-05159-EF-1. Rockville, MD: Agency for Healthcare Research and Quality; October 2011.
190. Lin CH, Chang KP, Huang SH. Deroofing: an effective method for treating chronic diffuse hidradenitis suppurativa. *Dermatol Surg.* 2016;42(2):273–275. [PubMed: 26808179]
191. Danby FW, Hazen PG, Boer J. New and traditional surgical approaches to hidradenitis suppurativa. *J Am Acad Dermatol.* 2015;73(5 Suppl 1):S62–S65. [PubMed: 26470619]
192. Kohorst JJ, Baum CL, Otley CC, et al. Patient satisfaction and quality of life following surgery for hidradenitis suppurativa. *Dermatol Surg.* 2017;43(1):125–133. [PubMed: 28027202]
193. Ritz JP, Runkel N, Haier J, Buhr HJ. Extent of surgery and recurrence rate of hidradenitis suppurativa. *Int J Colorectal Dis.* 1998;13(4):164–168. [PubMed: 9810520]
194. van Rappard DC, Mooij JE, Mekkes JR. Mild to moderate hidradenitis suppurativa treated with local excision and primary closure. *J Eur Acad Dermatol Venereol.* 2012;26(7):898–902. [PubMed: 21812838]
195. Blok JL, Boersma M, Terra JB, et al. Surgery under general anaesthesia in severe hidradenitis suppurativa: a study of 363 primary operations in 113 patients. *J Eur Acad Dermatol Venereol.* 2015;29(8):1590–1597. [PubMed: 25589154]
196. Miedema J, Sayed C. Staged excision in the outpatient setting for the treatment of axillary hidradenitis suppurativa. *Dermatol Surg.* 2016;42(2):267–269. [PubMed: 26808184]
197. Kagan RJ, Yakuboff KP, Warner P, Warden GD. Surgical treatment of hidradenitis suppurativa: a 10-year experience. *Surgery.* 2005;138(4):734–740. discussion 740-731. [PubMed: 16269303]
198. Yamashita Y, Hashimoto I, Matsuo S, Abe Y, Ishida S, Nakanishi H. Two-stage surgery for hidradenitis suppurativa: staged artificial dermis and skin grafting. *Dermatol Surg.* 2014;40(2):110–115. [PubMed: 24330271]
199. Orgill DP. Excision and skin grafting of thermal burns. *N Engl J Med.* 2009;360(9):893–901. [PubMed: 19246361]
200. Kuo HW, Ohara K. Surgical treatment of chronic gluteal hidradenitis suppurativa: reused skin graft technique. *Dermatol Surg.* 2003;29(2):173–178. [PubMed: 12562349]
201. Ludolph I, Titel T, Beier JP, et al. Penile reconstruction with dermal template and vacuum therapy in severe skin and soft tissue defects caused by Fournier's gangrene and hidradenitis suppurativa. *Int Wound J.* 2016;13(1):77–81. [PubMed: 24618357]
202. World Health Organization. *Cancer Pain Relief with a Guide to Opioid Availability.* 2nd ed. Geneva, Switzerland: World Health Organization; 1996.
203. Horvath B, Janse IC, Sibbald GR. Pain management in patients with hidradenitis suppurativa. *J Am Acad Dermatol.* 2015;73(5 Suppl 1):S47–S51. [PubMed: 26470616]

204. Enamandram M, Rathmell JP, Kimball AB. Chronic pain management in dermatology: a guide to assessment and nonopioid pharmacotherapy. *J Am Acad Dermatol.* 2015;73(4):563–573. quiz 573-564. [PubMed: 26369840]
205. Schug SA. The role of tramadol in current treatment strategies for musculoskeletal pain. *Ther Clin Risk Manag.* 2007;3(5):717–723. [PubMed: 18472996]
206. Alavi A, Farzanfar D, Lee RK, Almutairi D. The contribution of malodour in quality of life of patients with hidradenitis suppurativa. *J Cutan Med Surg.* 2018;22(2):166–174. [PubMed: 29231053]
207. Alavi A, Sibbald RG, Kirsner RS. Optimal hidradenitis suppurativa topical treatment and wound care management: a revised algorithm. *J Dermatolog Treat.* 2017:1–2. [PubMed: 28201943]
208. Antia C, Alavi A, Alikhan A. Topical management and wound care approaches for hidradenitis suppurativa. *Semin Cutan Med Surg.* 2017;36(2):58–61. [PubMed: 28538745]
209. Gan SD, Graber EM. Laser hair removal: a review. *Dermatol Surg.* 2013;39(6):823–838. [PubMed: 23332016]
210. Sotiriou E, Apalla Z, Maliamani F, Ioannides D. Treatment of recalcitrant hidradenitis suppurativa with photodynamic therapy: report of five cases. *Clin Exper Dermatol.* 2009;34(7):e235–236. [PubMed: 19508581]
211. Sehgal VN, Verma P, Sawant S, Paul M. Contemporary surgical treatment of hidradenitis suppurativa (HS) with a focus on the use of the diode hair laser in a case. *J Cosmet Laser Ther.* 2011;13(4):180–190. [PubMed: 21714587]

CAPSULE SUMMARY

- Evidence regarding the epidemiology, diagnosis, surgical treatment, and complementary management strategies of hidradenitis suppurativa is increasing but no management guidelines currently exist in North America.
- Grading of the available evidence is reviewed in this article and recommendations for optimal disease management are provided.

Table I.

Strength of recommendations for the management and treatment of HS

Recommendations	Strength of recommendation	Level of evidence	References
Grading/classification system			
Hurley staging	B	II	1
HISCR	A	I	2
HS-PGA	B	II	2
Sartorius	B	II	1
DLQI	A	I	1,3,4
Pain VAS	A	I	1,2,4,5
HSIA	B	II	6
HSSA	B	II	6
Microbiologic testing	C*	III	7-15
Biomarker/genetic testing	Not recommended	III	7,16-33
Comorbidity screening			
Smoking	A	I, II	34-38
Metabolic syndrome	A	I, II	34-38
Type II diabetes	A	I, II	34,35,38-41
Follicular occlusion tetrad	A	II	42
Acne	A	I	43
Depression/anxiety	A	I, II	34,35,37,38,44
Squamous cell carcinoma (of HS-affected skin)	C	II	45
Inflammatory bowel disease	A	II	42,46
Pyoderma gangrenosum and autoinflammatory syndromes [†]	B	II	37,42
Arthropathies [‡]	B	II	42,45
Polycystic ovarian syndrome [‡]	A	I, II	35,47,48
Impaired sexual health	A	I, II	49-51

Recommendations	Strength of recommendation	Level of evidence	References
Down syndrome	A	I, II	52,53
Laser/light therapies			
Intense pulsed light	C	III	54,55
Nd:YAG	B	II	56-58
Alexandrite	C	III	59
Diode	C	III	60
CO ₂	C	II, III	61-67
Fractionated CO ₂ (for scars)	C	III	68,69
Photodynamic therapy	C	II, III	70-77
External beam radiation therapy	C	III	78,79
Electrosurgery/radiofrequency	C	III	80,81
Surgical interventions			
Wide excision	B	II	82-87
• Wound closure, secondary intention	C	II	87-92
• Wound closure, delayed primary closure)	C	II	93
• Wound closure, skin graft	C	II	89,92,94-96
• Wound closure, flaps	C	II	89,94,95,97,98
• Wound closure, skin substitutes	C	II	99
Unroofing/deroofting	B	II	84,87,89,100-102
Laser evaporation	C	II	66,67,103
CO ₂ laser excision	C	II	63,65
Electrosurgical peeling	C	II	81,104
Cryosurgery	C	III	105,106
Abscess drainage	C	II	84,89,100,107,108
Combined medical and surgical treatment	C	II	109,110
Alternative interventions			
Smoking cessation	C	III	111,112

Recommendations	Strength of recommendation	Level of evidence	References
Zinc	C	II	113-119
Vitamin D	C	II	120
Brewer's yeast avoidance	C	II	121
Dairy avoidance	C	III	122
Weight loss	C	II	111,119,123-125
Mechanical irritation (friction, rubbing, compression)	C	III	126-130
Close shaving avoidance	C	II	131,132
Wound care			
Gentamycin sulfate	C	III	133
Manuka honey	C	III	134,135
NPWT	C	III	93,136-145
PRP	C	III	146,147
Hydrofiber	C	III	62,64
Silastic dressing	C	III	148
Pain management			
Disease control improves pain	B	II	149,150
Cautious use of short-acting opiates for acute pain	C	III	151
Management of chronic pain by using WHO pain ladder	C	III	151

Strength of Recommendation Taxonomy recommendation level: I, good-quality patient-oriented evidence; II, limited-quality patient-oriented evidence; and III, other evidence, including consensus guidelines, opinion, case studies, or disease-oriented evidence. Evidence grading level: A, recommendation based on consistent and good-quality patient-oriented evidence; B, recommendation based on inconsistent or limited-quality patient-oriented evidence; and C, recommendation based on consensus, opinion, case studies, or disease-oriented evidence.¹⁵²

DLQI, Dermatology Life Quality Index; *HISCR*, hidradenitis suppurativa clinical response; *HS*, hidradenitis suppurativa; *HSA*, Hidradenitis Suppurativa Impact Assessment; *HS-PCA*, Hidradenitis Suppurativa Physician's Global Assessment; *HSSA*, Hidradenitis Suppurativa Symptom Assessment; *Nd:YAG*, neodymium-doped yttrium-aluminum-garnet; *NPWT*, negative-pressure wound therapy; *PRP*, platelet-rich plasma; *VAS*, visual analog scale; *WHO*, World Health Organization.

* Recommended only when infection is in differential or secondary infection is suspected, not in routine care.

[†] Screen only if signs and symptoms present.

Table II.

Recommendations for grading and classification

Clinical performance, Hurley staging, and inflammatory lesion counts (abscesses and inflammatory lesions) are recommended.

Consider clinically following pain VAS and DLQI.

The recommended grading systems in research studies are the HiSCR, HS-PGA, Sartorius score, DLQI, and pain VAS; the HSIA and HSSA can also be considered.

DLQI, Dermatology Life Quality Index; *HiSCR*, Hidradenitis Suppurativa Clinical Response; *HSIA*, Hidradenitis Suppurativa Impact Assessment; *HS-PGA*, Hidradenitis Suppurativa Physician's Global Assessment; *HSSA*, Hidradenitis Suppurativa Symptom Assessment; *VAS*, visual analog scale.

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Table III.

Recommendations for screening for comorbidities

Perform a review of systems and a physical examination to screen for metabolic syndrome, depression, anxiety, diabetes, PCOS, and tobacco abuse.

Refer patients with additional risk factors for diabetes such as obesity, hypertension, hyperlipidemia, and acanthosis nigricans for HbA1c and/or fasting glucose testing.

Screen for depression, inflammatory bowel disease, autoinflammatory syndromes, and inflammatory arthropathy based on review of systems.

HbA1c, Glycosylated hemoglobin type A1c; *PCOS*, polycystic ovarian syndrome.

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Table IV.

Recommendations for lifestyle modifications and alternative treatments

Counsel smoking cessation.

Screen for obesity and counsel weight loss.

May recommend oral zinc supplements (weak evidence).

Insufficient evidence exists to recommend avoidance of dairy or brewer's yeast, vitamin D supplementation, avoidance of friction, deodorant, and depilation/shaving.

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Table V.

Recommendations for surgical modalities

Recurrent nodules and tunnels may be best treated with derroofing or excision.

Incision and drainage is recommended only for acute abscesses to relieve pain.

Wide local scalpel, CO₂, or electrosurgical excision (with or without reconstruction) is appropriate for extensive chronic lesions.

Wound healing following surgery may be through secondary intention, primary closure, delayed primary closure, flaps, grafts, and/or skin substitutes.

Experience suggests that continuing medical therapy in the perioperative period is likely to be beneficial and poses minimal risk of increased postoperative complications.

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Table VI.

Recommendations for pain management

Pain management in HS starts with disease control.

The multidimensional aspects of pain should be considered when dealing with pain management.

In select cases of severe pain, use of individualized, carefully prescribed short-acting opioid analgesics may be needed.

Recommend that chronic pain be managed according to the World Health Organization pain ladder.²⁰²

HS, Hidradenitis suppurativa.

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Table VII.**Recommendations for wound care**

Local wound care for surgical and nonsurgical wounds in HS follows the principles of best-practice individualized wound care.

Choice of dressing is based on the amount of drainage, location, periwound skin condition, cost, and patient preference.

Use of antiseptic washes is generally supported by expert opinion, though it carries low risk of contact dermatitis.

Use of negative-pressure therapy for selected large open wounds for a short period (1-4 weeks) followed by delayed reconstruction may be beneficial.

HS, Hidradenitis suppurativa.

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Table VIII.

Recommendations for light, laser, and energy sources

An Nd:YAG laser is recommended in patients with Hurley stage II or /III disease on the basis RCT and case series data and in patients with Hurley stage I disease on the basis of expert consensus.

Other wavelengths that are used for follicular destruction are recommended on the basis of lower-quality evidence.

CO₂ laser excision is recommended in patients with Hurley stage II or III disease with fibrotic sinus tracts.

External beam radiation and PDT have a limited role in the management of patients with HS.

HS, Hidradenitis suppurativa; *Nd:YAG*, neodymium-doped yttrium-aluminum-garnet; CO₂, carbon dioxide; RCT, randomized controlled trial; PDT, photodynamic therapy.