Published in final edited form as:

Dermatology. 2020 ; 236(5): 393–412. doi:10.1159/000507323.

Medical and surgical management of hidradenitis suppurativa: a review of international treatment guidelines and implementation in general dermatology practice

Lauren A. V. Orenstein, MD[1], **Tien V Nguyen, MD**[2], **Giovanni Damiani, MD**[3], **Christopher Sayed, MD**[4], **Gregor B.E. Jemec, MD, DMSci**[5], **Iltefat Hamzavi, MD**[6]

[1]Department of Dermatology, Emory University School of Medicine, Atlanta, GA.

[2]Bellevue Dermatology Clinic & Research Center, Bellevue, WA.

[3]Dipartimento di Fisiopatologia Medico-Chirurgica e dei Trapianti, Università degli Studi di Milano, Unità Operativa di Dermatologia, IRCCS Fondazione Ca' Granda, Ospedale Maggiore Policlinico, Milano, Italy.

[4]Department of Dermatology, University of North Carolina School of Medicine, Chapel Hill, NC.

[5]Department of Dermatology, Zealand University Hospital, Roskilde, Denmark; Health Sciences Faculty, University of Copenhagen, Denmark.

[6]Department of Dermatology, Henry Ford Hospital, Detroit, Michigan.

Abstract

Corresponding author: Lauren A.V. Orenstein, MD, 1525 Clifton Rd NE, Dermatology, Suite 100, Atlanta, GA 30322, Lauren.Orenstein@emory.edu, Phone: +001 404-778-3084.

Author contributions statement:

LO: Conceptualized the review and content to include, wrote initial draft of manuscript, revised manuscript to incorporate suggestions from other authors, accountable for accuracy and integrity of work, final approval of manuscript.

TN: Substantial contribution to conception of the work, assisted in critical revisions for intellectual content, approved final version, and agreed to be accountable for all aspects of work.

GD: Substantial contribution to acquisition and interpretation of data for the manuscript, critical revisions for intellectual content, approved final version, and agreed to be accountable for all aspects of work.

CS: Substantial contribution to design of work and acquisition of data for work, critical revisions for intellectual content, approved final version, and agreed to be accountable for all aspects of work.

GBEJ: Substantial contribution to conception and design of manuscript, critical revisions for intellectual content, approved final version, and agreed to be accountable for all aspects of work.

IH: Substantial contribution to conception and design of manuscript, senior author oversight, critical revisions for intellectual content, approved final version, and agreed to be accountable for all aspects of work.

Conflicts of interest:

LO: Grant from ChemoCentryx for participation as investigator; Honoraria from Huron Consulting Group and MedEd Solutions, LLC for participation on advisory boards; Honorarium from Frontline Medical Communications for speaking on educational video.

TN: Consulting fees: Celgene.

GD: No conflicts of interest to disclose.

CS: Speakers Bureau: AbbVie, Novartis; Consulting fees: InflaRx, AbbVie; Grant: InflaRx, UCB.

GBEJ: Honoraria from AbbVie, Janssen-Cilag, Novartis, Leo pharma, Chemocentryx, Incyte, and UCB for participation on advisory boards, and grants from Abbvie, InflRx, Janssen-Cilag, Leo Pharma, Novartis, Regeneron and Serono for participation as an investigator, and received speaker honoraria from AbbVie, and Novartis. He has furthermore received unrestricted research grants from Leo Pharma and Novartis.

IH: Advisory board: AbbVie; Grant/Research Funding: Clinuvel, Estee Lauder, Ferndale Laboratories, Inc., Galderma Laboratories, L.P., Janssen Biotech, Loreal, PCORI, Pfizer, Bayer, Lenicura, Unigen Inc., Allergan, GE, Johnson & Johnson, Incyte, Bristol-Myers Squibb, Merck, Abbvie; Consulting fees: Incyte; President of the HS Foundation; Co-Chair Global Vitiligo Foundation

Background: Hidradenitis suppurativa (HS) is a chronic painful skin disease that severely impairs patients' quality of life. While high quality trials of HS therapies remain limited, medical knowledge of best treatment practices is rapidly evolving, leading to recent publication of multiple international treatment guidelines for HS.

Summary: This review compares international HS treatment guidelines, describes evidence for effectiveness of common and emerging HS therapies, and provides guidance for integrating evidence-based HS care into practice. Although over 50 medical and procedural treatments are mentioned across international HS guidelines, only adalimumab and infliximab have grade B/weak recommendation or higher across all major guidelines. This review describes appropriate patient selection and effectiveness of the most commonly used medical and procedural treatments for HS. It also includes recommendations for counseling, dosing, and duration of medical therapies as well as procedure videos for the practicing dermatologist.

Key Messages: Few HS treatments outside of adalimumab are currently supported by high quality randomized clinical trials, contributing to divergence in international treatment guidelines. This article reviews evidence for implementing best practices in HS treatment in the general dermatology clinic.

Keywords

Acne inversa; Biologicals; hidradenitis suppurativa; Surgical techniques

Introduction:

Hidradenitis suppurativa (HS) is a chronic disease causing painful, malodorous nodules and abscesses that scar to form sinus tracts/tunnels. HS has a devastating impact on quality of life,(1,2) contributing to chronic pain,(3) poor mental health,(4) substance use disorder,(5) impaired intimate relationships,(6,7) and suicide rates 2.4 times that of the general population.(8) While multiple HS treatment guidelines exist, (9–13) paucity of high quality evidence limits the strength of their recommendations. This article reviews medical and surgical management of HS, with an emphasis on comparison of international guidelines and integrating evidence-based HS care into practice.

MEDICAL MANAGEMENT OF HS

TOPICAL THERAPIES

Key points

- Topical clindamycin is appropriate for mild localized disease.
- Antibiotic resistance is common among bacteria cultured from HS lesions but does not seem to impact antibiotics' effectiveness in treating HS. Topical antimicrobial use promotes antibiotic stewardship.

Topical clindamycin

Patient selection: Clindamycin is the only topical antibiotic with randomized controlled trials (RCTs) in HS and should be used for mild, localized disease.

Effectiveness: A RCT (n=27) demonstrated decreased pustule count and improved patient assessment compared with placebo; however, abscess and nodule counts remained unchanged.(14) Another RCT (n=46) showed no significant difference between topical clindamycin versus oral tetracycline.(15)

Antimicrobial washes: benzoyl peroxide, chlorhexidine, and zinc pyrithione

Patient selection: Addition of an antimicrobial wash may be considered with concomitant antibiotic use.

Effectiveness: In a RCT of Nd:YAG laser (n=22), controls reported a 22% clinical improvement when treated with benzoyl peroxide 10% and clindamycin 1%.(16) One small study found that antimicrobial washes were associated with lower resistance to cephalosporins but not other antibiotics.(17) Because antimicrobial resistance is common among HS patients using topical or systemic antibiotics,(18–20) it is worthwhile to consider the addition of a topical antimicrobial to promote antibiotic stewardship.

Resorcinol

Patient selection: Resorcinol 15% cream may be used for acute and chronic lesions in mild-to-moderate disease.

Effectiveness: Uncontrolled studies of resorcinol 15% BID in mild-to-moderate disease have shown resolution in 66% of lesions when used as maintenance(21) and reduction in pain and abscess duration during flares.(22)

Counseling: Common side effects include desquamation, irritant contact dermatitis, and reversible hyperpigmentation.(21,22) Resorcinol with intense pulsed light therapy may cause severe irritant reactions.(23)

SYSTEMIC ANTIBIOTICS

Key points

- Routine microbiologic cultures are not recommended in HS.
- Tetracyclines are first line therapy for mild-to-moderate widespread HS.
- Clindamycin/rifampin is first-line for moderate-to-severe disease.

Systemic antibiotics are widely used and recommended in all published HS treatment guidelines. (9–13) Yet, our understanding of antibiotics' mechanisms of action in treating HS remains limited. Despite high levels of antimicrobial resistance among bacteria cultured from HS lesions,(18–20) no link between antimicrobial resistance and HS treatment response has been established. Thus, routine cultures are not recommended.(10,12)

Tetracyclines:

Patient selection: Oral tetracyclines are first line for mild-to-moderate multifocal HS.

Effectiveness: The only RCT of systemic antibiotics in HS compared tetracycline 500 mg BID against clindamycin 1% BID in 46 patients with Hurley stage I/II HS. Both groups had reduced abscess counts, but there were no significant differences between groups. (15)

Duration: Tetracyclines have been studied for up to 4 months of consecutive therapy, but may be extended if clinically indicated.(9,11,13)

Clindamycin/Rifampin:

Patient selection: Clindamycin/rifampin can be a first-line treatment in patients with moderate-to-severe HS or second-line for mild disease. Patients who are ≥50 years old or ever-smokers are less likely to tolerate this combination.(24) Rifampin induces the cytochrome P-450 system leading to numerous medication interactions, including reduced effectiveness of hormonal birth control. This regimen may select for rifampin-resistant strains of *M. tuberculosis*, hence TB screening or avoiding this regimen may be indicated in high risk populations.(25)

Effectiveness: Among 6 case series totaling 178 patients, clinical improvement rates ranged from 63–85%,(26–31) with remission in 11–57%.(26–28) Although one series reported 0% relapse rate,(26) two studies showed 59–61.5% relapse 4–5 months after stopping treatment. (27,30)

Duration: Although usually continued for only 10–12 weeks, longer treatment courses with clindamycin/rifampin seem to confer similar risks.(32) Starting rifampin 1 week prior to clindamycin may reduce GI discomfort.(33,34)

Metronidazole/Moxifloxacin/Rifampin:

Patient selection: Triple antibiotic therapy may be used for second- or third-line treatment in mild-to-moderate HS.

Effectiveness: A series of 28 patients reported complete remission in 6/6 patients with Hurley I, 8/10 with Hurley II, and 2/12 with Hurley III disease.(35) A second case series of 28 patients with severe Hurley Stage I disease found a clinical remission rate of 75% at week 12, with long term benefits demonstrated by reduced number of flares at 1 year follow up.(36)

Duration: In these series, therapy began with metronidazole 500 mg TID, moxifloxacin 400 mg daily, and rifampin 10 mg/kg/day. Metronidazole was discontinued after 6 weeks to reduce neurologic risks (e.g. aseptic meningitis and peripheral neuropathy). Moxifloxacin and rifampin were continued for an additional 4 weeks(35) or until 6 weeks after remission. (36) Remission was then maintained with trimethoprim-sulfamethoxazole (400 mg/80 mg daily) or doxycycline (100 mg/day).

Dapsone:

Patient selection: Due to sparse evidence and need for laboratory monitoring,(37) dapsone should be reserved for third-line treatment in patients with mild-to-moderate disease.

Effectiveness/Duration: In the largest published case series, 6/24 patients (25%) experienced clinically significant improvement with rapid relapse upon cessation.(38) None of those with Hurley stage III HS (n=4) improved.

Ertapenem

Patient selection: Intravenous ertapenem is reserved for severe, treatment-refractory HS. Ertapenem may be used as a bridge to surgery or consolidation medical treatment. In the authors' clinical experiences, surgery is scheduled around week 4–6 of ertapenem therapy.

Effectiveness: In one case series, 35/36 (97.2%) patients improved.(39) However, 30/36 patients relapsed within a mean of 5.8 weeks. In another series (n=30), the median Sartorius score improved significantly,(40) although none of the Hurley stage III anatomic areas entered remission. Treatment with oral antibiotics after ertapenem was associated with prolonged remission and continued improvement.(40)

Duration/counseling: The target duration for ertapenem is 6 weeks. Common side effects include oral/vaginal candidiasis, gastrointestinal discomfort, and vaginitis. PICC line thrombosis/lymphangitis was seen in 5/66 patients.(39,40)

CORTICOSTEROIDS

Key points

- Intralesional triamcinolone may be used for acute HS flares.
- Systemic corticosteroids should not be used routinely due to side effects. Intralesional triamcinolone

Patient selection: Intralesional triamcinolone acetonide (ILK) may be used for HS nodules, abscesses, and draining sinuses.

Effectiveness: Results remain mixed. One case series (n=36) of ILK 10 mg/mL for acute HS nodules and abscesses demonstrated a significant decrease in patient reported pain within 1–2 days and improvement in physician assessment.(41) In a second uncontrolled study, injection of 0.5 mL of triamcinolone 40 mg/mL into fistulous tracts measuring <25 mm resulted in clinical resolution in 72% of cases (n=53).(42) However, a recently published RCT (n=55) of 0.1mL of ILK 10 mg/mL vs ILK 40 mg/mL vs normal saline showed no difference between treatment and placebo.(43)

Systemic corticosteroids

Patient selection: Caution must be exercised in patients with comorbidities such as hypertension, diabetes mellitus, osteopenia/osteoporosis, and psychiatric disorders.

Effectiveness: In a case series of 13 patients with recalcitrant disease, adding low dose prednisone (10 mg/day) to ongoing treatment with adalimumab, acitretin, doxycycline, or clindamycin/rifampin induced remission in 5 (38.5%) and partial response in 6 (46.2%).(44)

HORMONAL THERAPIES

Anti-androgen contraceptives

Patient selection: COCPs are helpful in women whose primary HS treatment is unsafe in pregnancy and may reduce spironolactone's side effects. Progesterone only contraception may worsen HS.(45)

Effectiveness: A RCT of 24 women comparing ethinyloestradiol/noregestrol vs ethinyloestradiol/cyproterone acetate demonstrated clinical improvement in both groups, with no difference in response between regimens.(46)

Finasteride

Patient selection: Finasteride may be an adjunctive treatment in those with mild-to-moderate disease who fail first- and second-line therapies.

Effectiveness: Significant improvement was observed in 13/14 participants across 4 case series.(47–50)

Metformin

Patient selection: Consider in diabetics, pregnant patients, and females with polycystic ovarian syndrome.(11)

Effectiveness: Two case series demonstrated subjective clinical improvement in 36/53 (68%)(51) and 18/25 (72%)(52) patients, respectively. One study also showed an improvement in Dermatology Life Quality Index (DLQI among 19/25 patients, with an average DLQI score reduction of 7.6 points.(52) Insulin resistance did not predict a favorable response to metformin.(51)

Dosing and duration: Start 500 mg daily and increase by 500 mg every 1–2 weeks as tolerated to 500 mg TID.(51) Improvement usually begins by 12 weeks of therapy and may continue through 24 weeks of treatment.(52)

Spironolactone

Patient selection: Spironolactone may be used as adjunctive therapy in young, healthy women with mild-to-moderate HS.

Effectiveness: Two case series totaling 66 women with mild to severe HS have shown improvement in pain, lesion score and physician global assessment.(53,54)

Other hormonal therapies—Liraglutide, a glucagon-like peptide-1 agonist, was used successfully in 2 case reports at doses of 1.8 mg daily. (55,56)

SYSTEMIC RETINOIDS

Key points

- Isotretinoin is not recommended for routine treatment of HS.

- Acitretin may be used as second- or third-line therapy in moderate disease.
  Isotretinoin

Patient selection: Healthy weight females with acne and milder HS are more likely to response to isotretinoin.(57)

Effectiveness: Although isotretinoin is commonly prescribed for HS,(58) data supporting its effectiveness are inconsistent. Five large case series/retrospective cohorts reported complete response in 26/194 (13%), partial response in 40 (21%), and no response in 128 (66%) participants.(57,59–63) One case series suggested that isotretinoin may exacerbate HS.(64). Of 16 complete responders in one series, 11 (69%) remained in remission after a mean follow-up of 56 months.(60)

Acitretin

Patient selection: Acitretin may be used to treat moderate-to-severe HS in patients without childbearing potential.

Effectiveness: Three case series and one trial have evaluated acitretin in treating HS,(65–68) but doses and outcome measures varied.

Dosing and Duration: High dose acitretin (0.5–0.6 mg/kg/day) appears more effective than lower doses (10–25 mg/day).(65–67) Clinical improvement usually begins within 3 months and may continue through the first 6 months.(66,67) Among complete responders, remission was maintained for a median of 10 months.(66,67)

BIOLOGIC THERAPY

Key points:

- Adalimumab is the only FDA-approved treatment for HS. It is first-line for patients ≥12 years old with moderate-to-severe disease.
- Adalimumab weekly is more effective than every other week dosing.
  Adalimumab

Patient selection: Adalimumab is a fully human monoclonal TNF-α antibody and is the first line biologic in patients with moderate-to-severe HS.

Effectiveness: Four RCTs have investigated adalimumab in HS.(69–71) PIONEER I (n=307) and PIONEER II (n=326) demonstrated Hidradenitis Suppurativa Clinical Response (HiSCR) rates of 41.8% for adalimumab versus 26.0% for placebo ($p = 0.003$) and 58.9% versus 27.6% ($p<0.001$), respectively.(69) HiSCR is a validated outcome measure defined as ≥50% reduction in total abscess and inflammatory nodule count, with no increase in abscess count.(72) Continuation of oral tetracyclines in PIONEER II may explain its higher response rates. Adalimumab reduces patient pain scores(73) and is associated with cost savings.(74) Among those who responded to adalimumab by week 12, half maintained response at week 36. Responders at week 36 tended to maintain response through 168 weeks of treatment.

(69,75) HLA-type may predict anti-drug antibody formation to both adalimumab and infliximab.(76) Adalimumab biosimilars have been reported in HS.(77)

Dosing/Duration: Adalimumab 40 mg weekly is more effective than 40 mg every other week(71,78), and if tolerated, may be continued indefinitely.(69,75) The FDA-approved dose for adolescents ≥ 12 years may differ from adult dosing (see Table 1).(79) Patients without improvement by 12 weeks are unlikely to benefit from additional treatment.(78)

Infliximab

Patient selection: Infliximab is a chimeric monoclonal TNF-α antibody. It is a second-line therapy in patients with severe HS. In the authors' experience, infliximab is often helpful for patients failing adalimumab, possibly due to greater dosing flexibility.

Effectiveness: A single-center RCT of infliximab 5 mg/kg every 8 weeks demonstrated ≥25% improvement in HS severity index (HSSI) in 12/15 (87%) patients on infliximab vs 2/18 (11%) on placebo as well as improvement in DLQI.(80) A systematic review of 71 reported cases found ≥50% improvement in HS Score in approximately 78% of patients.(81) A retrospective cohort study (n=52) concluded that the starting dosing schedule of 10 mg/kg every 6–8 weeks is more effective than lower starting doses.(82) Elevated IL-6 and high-sensitivity CRP may predict a better response to infliximab.(83)

Duration: With infliximab monotherapy, relapse occurs in approximately 50% of patients after a median of 37 weeks.(81) Anti-drug antibody formation occurs in approximately 17% of patients after a mean of 13 months.(84) In those who maintain a satisfactory clinical response, infliximab may be continued for long-term maintenance.(85)

Apremilast

Patient selection: The phosphodiesterase-4 inhibitor apremilast may be used as second-line therapy for patients with mild-to-moderate disease.

Effectiveness: One RCT (n=20) demonstrated HiSCR in 8/15 (53%) patients receiving apremilast compared to 0/5 receiving placebo.(86) Similar results were reported in a prospective open-label phase 2 study of apremilast (HiSCR in 11/20, 55%).(87)

Duration: In published studies, apremilast was continued for 16–24 weeks.

Anakinra

Patient selection: Anakinra, an interleukin-1 receptor inhibitor, may be used to treat moderate-to-severe HS.

Effectiveness: In one RCT, HiSCR was achieved at 12 weeks in 7/9 (79%) patients receiving anakinra vs 3/10 (30%) on placebo (p=0.02).(88)

Duration: Twelve weeks after anakinra cessation, there was no significant difference in the anakinra vs placebo arms, suggesting that HS relapses upon cessation of therapy.(88) In a

case series two patients with initial response to anakinra, response was lost after 3–7 years.(89)

Ustekinumab

Patient selection: Those with moderate disease (versus severe) and lower expression of leukotriene A4-hydrolase may respond more favorably.(90)

Effectiveness: In an open-label study of ustekinumab given to 17 patients with moderate-to-severe HS for 28 weeks, HiSCR-50 was achieved in 47% of participants 12 weeks after cessation of therapy.(90) The proportion of patients in which HS had a very large or extremely large effect on daily life decreased from 71% at the beginning of the study to 59%.(90) A retrospective review (n=14) of ustekinumab infused intravenously followed by subcutaneous maintenance dosing found that 71% of patients experienced ≥30% improvement in DLQI and VAS Pain Score.(91)

Etanercept—The ALLIANCE group recommends against etanercept use in HS.(10) The only double-blinded RCT of etanercept 50 mg twice weekly demonstrated no significant improvement in patient- or physician-reported outcomes.(92) Open label trials of etanercept have shown mixed results using doses of 50–100 mg weekly.(93–97)

Other biologics – golimumab, secukinumab, and guselkumab—Two case reports using the TNF-α inhibitor golimumab have been published. The report suggesting benefit used higher doses (200 mg IV followed by 100 mg IV every 4 weeks) than were used in the negative case report.(98,99)

Inflammatory pathways involving IL-23 and IL-17 producing T helper cells have been implicated in the pathogenesis of HS.(100) The IL-17 inhibitor secukinumab has been used in several cases(101–104) and demonstrated HiSCR in 7/9 (78%) of patients in a prospective open-label study.(105) Guselkumab is a monoclonal antibody that targets subunit p19 of IL23 and has been reported to ameliorate refractory moderate-to-severe HS but sometimes requires ≥4 months before improvement begins.(106)

OTHER MEDICAL TREATMENTS

Zinc gluconate: HS patients have high risk of low zinc levels.(107) Two case series totaling 88 patients have demonstrated modest clinical and DLQI improvement among Hurley stage I/II patients treated with zinc gluconate 90 mg/day with or without topical triclosan 2% BID.(108,109) Zinc's most common side effect is gastrointestinal discomfort. However, excessive zinc supplementation may cause copper deficiency, iron deficiency anemia, leukopenia, and neutropenia.(110,111)

Colchicine: A prospective case series of 20 patients demonstrated improvement in DLQI and patient global assessment using a regimen of minocycline 100 mg daily and colchicine 0.5 mg BID x 6 months, followed by colchicine 0.5 mg BID x 3 months.(112) The only prospective series of colchicine monotherapy 0.5 mg BID for up to 4 months demonstrated no clinically relevant improvement.(113)

Cyclosporine: A retrospective case series of 18 patients treated with cyclosporine 2.0–3.5 mg/kg showed some benefit in half of patients.(114)

For a summary of guideline-based recommendations for medical management and lifestyle modifications in HS see Tables 1 and 2. Studies of many promising agents in patients with HS are ongoing, including medications which target IL-1 α, IL-17, IL-23, complement, and Janus kinase-1. For an updated list of trials being conducted in the United States, visit www.clinicaltrials.gov.

PROCEDURAL MANAGEMENT OF HS

Few high quality studies of procedural interventions in HS exist. Hence, guidelines for procedural management are somewhat disparate (Table 3). This section discusses 3 procedures: neodymium-doped yttrium aluminum garnet laser (Nd:YAG), deroofing, and excision. Videos demonstrating HS deroofing and excision are available in the online supplement.

Nd:YAG Laser

Long-pulsed Nd:YAG (1064 nm) causes selective photothermolysis of the follicular unit (Figure 1). One RCT demonstrated a 65% reduction in disease severity after 3 monthly treatments, with better results in Hurley stage II disease and in inguinal and axillary sites.(16,115,116) Recommended starting settings are based on Fitzpatrick skin type (Type I-III: fluence 40–50 J/cm^2, pulse duration 20 ms, spot size 10 mm; Type IV-VI: fluence 35–50 J/cm^2, pulse duration 35 ms, spot size 10 mm).(117) Nodules should be treated with double pulsing, while background lesional skin is treated with a single pulse.

Deroofing

Deroofing is a tissue sparing technique used to treat recurrent HS lesions. See Figure 2 for description and photographs of the procedure and Video 1 for video demonstration. A meta-analysis estimated recurrence rate after deroofing at 27.0%.(118)

Skin-sparing excision with electrosurgical peeling (STEEP)

Skin-sparing excision with electrosurgical peeling (STEEP) is a tissue-sparing technique in which an electrosurgical wire loop is successively passed over the sinus tract in tangential sections until the epithelialized floor of the sinus tract is exposed.(119) Similar to deroofing, the aim of STEEP is to remove all lesional tissue and scar, while leaving the epithelialized floor of the sinus tract and the subcutaneous fat intact.

Excision

Unlike deroofing, excision removes tissue to the depth of subcutaneous fat to completely eliminate the sinus tract (Figure 3, Figure 4, Video 2). Anesthesia with local infiltration or tumescent technique reduces the risk of bleeding and toxicity in larger surgical cases. Excision is performed using a scalpel, electrosurgery, or ablative CO_2 laser (10,600 nm). Debulking using the CO_2 laser may offer improved hemostasis and visualization of the operative field (Figure 5). CO_2 laser settings for vaporization or excision of sinus tracts are

fluence 55W, continuous wave pulse duration. A meta-analysis estimated HS recurrences at 22.0% following local excision and 13.0% following wide excision.(118) Although not commonly available, ultrasound characterization of a fistula may inform its likelihood of responding to medical therapy and may aid in identifying surgical candidates.(120)

Closure techniques

There is no consensus regarding the optimal closure technique following HS excision. Closure techniques frequently employed include secondary intent healing, primary linear closure, graft, and flap. The closure technique may be selected based on patient preference and provider assessment of perioperative risks including bleeding, infection, dehiscence, graft necrosis, and preservation of function/range of motion.

Conclusion

HS is a chronic inflammatory disease with substantial impact on quality of life. Evidence-based guidelines provide insight into best management practices, yet remain limited by low quality evidence and lack of standardized outcome measures. The dermatologic community's understanding of HS pathophysiology and therapeutic targets is rapidly evolving, providing a rationale for the many promising therapies in ongoing clinical trials. (121,122)

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding: Dr. Orenstein's participation was supported in part by the Building Interdisciplinary Research Careers in Women's Health of the National Institutes of Health under Award number K12D085850. The funding agency did not have any input in the study design, data collection, data analysis, manuscript publication, or publication decisions. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

References

1. Wolkenstein P, Loundou A, Barrau K, Auquier P, Revuz J. Quality of life impairment in hidradenitis suppurativa: A study of 61 cases. J Am Acad Dermatol [Internet]. 2007 [cited 2018 Oct 5];56:621–3. Available from: https://ac-els-cdn-com.proxy.library.emory.edu/S0190962206023590/1-s2.0-S0190962206023590-main.pdf?_tid=28497ca4-b9ca-4b74-af82-360eb8ce108e&acdnat=1538750222_72e922428d181efccaa0640ebc7423ce
2. Hamzavi IH, Sundaram M, Nicholson C, Zivkovic M, Parks-Miller A, Lee J, et al. Uncovering burden disparity: A comparative analysis of the impact of moderate-to-severe psoriasis and hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 2017 12 1 [cited 2018 Apr 1];77(6):1038–46. Available from: https://proxy.library.upenn.edu:2067/science/article/pii/S0190962217321564
3. Patel ZS, Hoffman LK, Buse DC, Grinberg AS, Afifi L, Cohen SR, et al. Pain, Psychological Comorbidities, Disability, and Impaired Quality of Life in Hidradenitis Suppurativa [corrected]. Curr Pain Headache Rep [Internet]. 2017 [cited 2019 Jan 21];21(12):49. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29094219
4. Onderdijk AJ, van der Zee HH, Esmann S, Lophaven S, Dufour DN, Jemec GBE, et al. Depression in patients with hidradenitis suppurativa. J Eur Acad Dermatology Venereol [Internet]. 2013 4 [cited 2019 Jan 21];27(4):473–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22339940

5. 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 [Internet]. 2018 [cited 2018 Dec 16];79(3):495–500. Available from: 10.1016/j.jaad.2018.02.053
6. Janse IC, Deckers IE, van der Maten AD, Evers AWM, Boer J, van der Zee HH, et al. Sexual health and quality of life are impaired in hidradenitis suppurativa: a multicentre cross-sectional study. Br J Dermatol [Internet]. 2017 4 [cited 2019 Jan 21];176(4):1042–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27534591
7. Cuenca-Barrales C, Ruiz-Villaverde R, Molina-Leyva A, Cuenca-Barrales C, Ruiz-Villaverde R, Molina-Leyva A. Sexual Distress in Patients with Hidradenitis Suppurativa: A Cross-Sectional Study. J Clin Med [Internet]. 2019 4 18 [cited 2019 Apr 24];8(4):532. Available from: https://www.mdpi.com/2077-0383/8/4/532
8. Thorlacius L, Cohen AD, Gislason GH, Jemec GBE, Egeberg A. Increased Suicide Risk in Patients with Hidradenitis Suppurativa. J Invest Dermatol [Internet]. 2018 [cited 2019 Jan 13];138:52–7. Available from: www.jidonline.org
9. Zouboulis CC, Desai N, Emtestam L, Hunger RE, Ioannides D, Juhász I, et al. European S1 guideline for the treatment of hidradenitis suppurativa/acne inversa. J Eur Acad Dermatology Venereol [Internet]. 2015 4 1 [cited 2018 Apr 1];29(4):619–44. Available from: http://doi.wiley.com/10.1111/jdv.12966
10. Zouboulis CC, Bechara FG, Dickinson-Blok JL, Gulliver W, Horváth B, Hughes R, et al. Hidradenitis suppurativa/acne inversa: a practical framework for treatment optimization – systematic review and recommendations from the HS ALLIANCE working group. J Eur Acad Dermatology Venereol [Internet]. 2019 10 23 [cited 2018 Nov 14];33(1):19–31. Available from: http://doi.wiley.com/10.1111/jdv.15233
11. Ingram JR, Collier F, Brown D, Burton T, Burton J, Chin MF, et al. British Association of Dermatologists guidelines for the management of hidradenitis suppurativa (acne inversa) 2018. Br J Dermatol [Internet]. 2018 12 15 [cited 2019 Jan 1];bjd.17537. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/bjd.17537
12. Alikhan A, Sayed C, Alavi A, Alhusayen R, Brassard A, Burkhart C, et al. 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. J Am Acad Dermatol[Internet]. 2019 [cited 2019 Mar 20];81(1):76–90. Available from: 10.1016/j.jaad.2019.02.067.
13. Alikhan A, Sayed C, Alavi A, Alhusayen R, Brassard A, Burkhart C, et al. North American clinical management guidelines for hidradenitis suppurativa: A publication from the United States and Canadian Hidradenitis Suppurativa Foundations: Part II: Topical, intralesional, and systemic medical management. J Am Acad Dermatol [Internet]. 2019 [cited 2019 Mar 20];81(1):91–101. Available from: 10.1016/j.jaad.2019.02.068.
14. Clemmensen OJ. Topical Treatment of Hidradenitis Suppurativa with Clindamycin. Int J Dermatol [Internet]. 1983 6 1 [cited 2018 Nov 21];22(5):325–8. Available from: http://doi.wiley.com/10.1111/j.1365-4362.1983.tb02150.x
15. Jemec GBE, Wendelboe P. Topical clindamycin versus systemic tetracycline in the treatment of hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 1998 12 1 [citde 2018 Nov 21];39(6):971–4. Available from: https://www-sciencedirect-com.proxy.library.emory.edu/science/article/pii/S0190962298702725
16. 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 [Internet]. 2010 [cited 2018 Nov 21];62(4):637–45. Available from: https://ac-els-cdn-com.proxy.library.emory.edu/S0190962209009827/1-s2.0-S0190962209009827-main.pdf?_tid=66d16a8e-c662-4dea-9ee8-8dce1461897f&acdnat=1542815246_e7dd40aaefeec9ca0a16bf70d86266cf
17. Leiphart PB, Ma HB, Naik MHSc HB, Kirby MS MEd JS. The effect of antimicrobial washes on antibacterial resistance in hidradenitis suppurativa lesions. J Am Acad Dermatol [Internet]. 2018 [cited 2019 Apr 3];80(3):821–2. Available from: 10.1016/j.jaad.2018.10.052

18. Fischer AH, Haskin A, Okoye GA. Patterns of antimicrobial resistance in lesions of hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 2017 2 1 [cited 2018 Nov 21];76(2):309–313.e2. Available from: https://www-sciencedirect-com.proxy.library.emory.edu/science/article/pii/S0190962216306156
19. Bettoli V, Manfredini M, Massoli L, Carillo C, Barozzi A, Amendolagine G, et al. Rates of Antibiotic Resistance / Sensitivity in Bacterial Cultures of Hidradenitis Suppurativa Patients. J Eur Acad Dermatology Venereol [Internet]. 2018 11 5 [cited 2018 Nov 21]; Available from: http://doi.wiley.com/10.1111/jdv.15332
20. 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 [Internet]. 2016 [cited 2018 Nov 21];29(3):161–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27351708
21. Pascual JC, Encabo B, Ruiz de Apodaca RF, Romero D, Selva J, Jemec GB. Topical 15% resorcinol for hidradenitis suppurativa: An uncontrolled prospective trial with clinical and ultrasonographic follow-up. 2017 [cited 2018 Nov 23]; Available from: 10.1016/j.jaad.2017.07.007
22. Boer J, Jemec GBE. Resorcinol peels as a possible self-treatment of painful nodules in hidradenitis suppurativa. Clin Exp Dermatol. 2010;35(1):36–40. [PubMed: 19549239]
23. Theut Riis P, Saunte DM, Sigsgaard V, Wilken C, Jemec GBE. Intense pulsed light treatment for patients with hidradenitis suppurativa: beware treatment with resorcinol [Internet]. Vol. 29, Journal of Dermatological Treatment. 2018 [cited 2018 Nov 23]. p. 385–7. Available from: http://www.tandfonline.com/action/journalInformation?journalCode=ijdt20
24. Schneller-Pavelescu L, Vergara-de Caso E, Martorell A, Romaní J, Lázaro M, Vilarrasa E, et al. Interruption of oral clindamycin plus rifampicin therapy in patients with hidradenitis suppurativa: an observational study to assess prevalence and causes. J Am Acad Dermatol [Internet]. 2018 [cited 2019 Apr 3]; Available from: 10.1016/j.jaad.2018.12.043
25. Mendes-Bastos P, Macedo R, Duarte R. Treatment of hidradenitis suppurativa with rifampicin: have we forgotten tuberculosis? Br J Dermatol [Internet]. 2017 10 1 [cited 2018 Nov 14];177(4):e150–1. Available from: http://doi.wiley.com/10.1111/bjd.15500
26. Mendonca CO, Griffiths CEM. Clindamycin and rifampicin combination therapy for hidradenitis suppurativa. Br J Dermatol [Internet]. 2006 5 1 [cited 2018 Nov 14];154(5):977–8. Available from: http://doi.wiley.com/10.1111/j.1365-2133.2006.07155.x
27. van der Zee HH, Boer J, Prens EP, Jemec GBE. The effect of combined treatment with oral clindamycin and oral rifampicin in patients with hidradenitis suppurativa. Dermatology [Internet]. 2009 [cited 2018 Nov 14];219(2):143–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19590174
28. Gener G, Canoui-Poitrine F, Revuz JE, Faye O, Poli F, Gabison G, et al. Combination therapy with clindamycin and rifampicin for hidradenitis suppurativa: a series of 116 consecutive patients. Dermatology [Internet]. 2009 [cited 2018 Nov 14];219(2):148–54. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19590173
29. Bettoli V, Zauli S, Borghi A, Toni G, Minghetti S, Ricci M, et al. Oral clindamycin and rifampicin in the treatment of hidradenitis suppurativa-acne inversa: a prospective study on 23 patients. J Eur Acad Dermatology Venereol [Internet]. 2014 1 1 [cited 2018 Nov 14];28(1):125–6. Available from: http://doi.wiley.com/10.1111/jdv.12127
30. Dessinioti C, Zisimou C, Tzanetakou V, Stratigos A, Antoniou C. Oral clindamycin and rifampicin combination therapy for hidradenitis suppurativa: a prospective study and 1-year follow-up. Clin Exp Dermatol [Internet]. 2016 12 1 [cited 2018 Nov 14];41(8):852–7. Available from: http://doi.wiley.com/10.1111/ced.12933
31. Ochi H, Tan LC, Oon HH. The effect of oral clindamycin and rifampicin combination therapy in patients with hidradenitis suppurativa in Singapore. Clin Cosmet Investig Dermatol [Internet]. 2018 [cited 2018 Nov 23];11:37–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29403298
32. Albrecht J, Baine PA, Ladizinski B, Jemec GB, Bigby M. Long-term clinical safety of Clindamycin and Rifampicin combination for the treatment of Hidradenitis suppurativa: a

critically appraised topic. Br J Dermatol [Internet]. 2018 10 3 [cited 2018 Nov 23]; Available from: http://doi.wiley.com/10.1111/bjd.17265

33. Marasca C, Masarà A, Annunziata MC, Bettoli V, Luciano MA, Fabbrocini G. Long-term clinical safety of Clindamycin and Rifampicin combination for the treatment of Hidradenitis Suppurativa: strategy to reduce side effects, improving patients' compliance. Br J Dermatol [Internet]. 2018 11 15 [cited 2018 Nov 23]; Available from: http://doi.wiley.com/10.1111/bjd.17423
34. Join-Lambert O, Ribadeau-Dumas F, Jullien V, Kitzis M-D, Jais J-P, Coignard-Biehler H, et al. Dramatic reduction of clindamycin plasma concentration in hidradenitis suppura-. Eur J Dermatol [Internet]. 2014 [cited 2019 Apr 20];24(February):2013–4. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24445967
35. Join-Lambert O, Coignard H, Jais J-P, Guet-Revillet H, Poirée S, Fraitag S, et al. Efficacy of rifampin-moxifloxacin-metronidazole combination therapy in hidradenitis suppurativa. Dermatology [Internet]. 2011 2 [cited 2018 Nov 14];222(1):49–58. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21109728
36. Delage M, Jais J-P, Lam T, Guet-Revillet H, Ungeheuer M-N, Consigny P-H, et al. Rifampin-moxifloxacin-metronidazole combination therapy for severe Hurley Stage 1 Hidradenitis Suppurativa: prospective short-term trial and one-year follow-up in 28 consecutive patients. J Am Acad Dermatol [Internet]. 2020; Available from: 10.1016/j.jaad.2020.01.007
37. Wolverton SE, Remlinger K. Suggested Guidelines for Patient Monitoring: Hepatic and Hematologic Toxicity Attributable to Systemic Dermatologic Drugs. Dermatol Clin [Internet]. 2007 [cited 2019 Apr 21];25(2):195–205. Available from: https://pdf.sciencedirectassets.com/273321/1-s2.0-S0733863507X00226/1-s2.0-S0733863507000149/main.pdf?x-amz-security-token=AgoJb3JpZ2luX2VjEL7%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJGMEQCIGKCKTNslaxdHLGODKAcu29K1u2gZTrBCkjONtcXXpBRAiBTxznFm1BYrML3
38. Yazdanyar S, Boer J, Ingvarsson G, Szepietowski JC, Jemec GBE. Dapsone therapy for hidradenitis suppurativa: a series of 24 patients. Dermatology [Internet]. 2011 [cited 2018 Nov 14];222(4):342–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21757878
39. Braunberger TL, Nartker NT, Nicholson CL, Nahhas AF, Parks-Miller A, Hanna Z, et al. Ertapenem - a potent treatment for clinical and quality of life improvement in patients with hidradenitis suppurativa. Int J Dermatol [Internet]. 2018 9 1 [cited 2018 Nov 14];57(9):1088–93. Available from: http://doi.wiley.com/10.1111/ijd.14036
40. Join-Lambert O, Coignard-Biehler H, Jais J-P, Delage M, Guet-Revillet H, Poirée S, et al. Efficacy of ertapenem in severe hidradenitis suppurativa: a pilot study in a cohort of 30 consecutive patients. J Antimicrob Chemother [Internet]. 2016 2 1 [cited 2018 Nov 14];71(2):513–20. Available from: https://academic.oup.com/jac/article-lookup/doi/10.1093/jac/dkv361
41. Theut Riis P, Boer J, Prens EP, L Saunte DM, Deckers IE, Emtestam L, et al. Intralesional triamcinolone for flares of hidradenitis suppurativa (HS): A case series. J Am Dermatology [Internet]. 2016 [cited 2018 Nov 23];75(6):1151–5. Available from: 10.1016/j.jaad.2016.06.049
42. Álvarez P, García-Martínez FJ, Poveda I, Pascual JC. Intralesional Triamcinolone for Fistulous Tracts in Hidradenitis Suppurativa: An Uncontrolled Prospective Trial with Clinical and Ultrasonographic Follow-Up. Dermatology [Internet]. 2019 5 29 [cited 2019 Jul 31];1–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/31141811
43. Sayed C. A Randomized Controlled Trial Evaluating the Efficacy of Intralesional Triamcinolone in Hidradenitis suppurativa. [Internet]. ClinicalTrials.gov. 2018. Available from: https://clinicaltrials.gov/ct2/show/results/NCT02781818?type=Intr&cond=hidradenitis+suppurativa&rank=27
44. Wong D, Walsh S, Alhusayen MBBS R. Low-dose systemic corticosteroid treatment for recalcitrant hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 2016 [cited 2019 Jan 2];75(5):1059–62. Available from: 10.1016/j.jaad.2016.07.030
45. Sawers RS, Randall VA, Ebling FJG. Hidradenitis suppurativa associated with use of oral contraceptives. Br J Dermatol [Internet]. 1986 [cited 2019 Jan 2];115(3):269–74. Available from: http://www.bmj.com/
46. Mortimer PS, Dawber RPR, Gales MA, Moore RA. A double-blind controlled cross-over trial of cyproterone acetate in females with hidradenitis suppurativa. Br J Dermatol [Internet]. 1986 9 1

[cited 2019 Jan 2];115(3):263–8. Available from: http://doi.wiley.com/10.1111/j.1365-2133.1986.tb05740.x

47. Joseph MA, Jayaseelan E, Ganapathi B, Stephen J. Hidradenitis suppurativa treated with finasteride. J Dermatolog Treat [Internet]. 2005 [cited 2019 Jan 16];16(2):75–8. Available from: http://www.tandfonline.com/action/journalInformation?journalCode=ijdt20
48. Farrell AMM, Randall VAA, Vafaee T, Dawber RPRP. Finasteride as a therapy for hidradenitis suppurativa. Br J Dermatol [Internet]. 1999;141(6):1138–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10722269%5Cnhttp://doi.wiley.com/10.1046/j.1365-2133.1999.03224.x
49. Mota F, Machado S, Selores M. Hidradenitis Suppurativa in Children Treated with Finasteride-A Case Series. Pediatr Dermatol [Internet]. 2017 9 1 [cited 2019 Jan 16];34(5):578–83. Available from: http://doi.wiley.com/10.1111/pde.13216
50. Randhawa HK, Hamilton J, Pope E. Finasteride for the Treatment of Hidradenitis Suppurativa in Children and Adolescents. JAMA Dermatology [Internet]. 2013 6 1 [cited 2019 Jan 16];149(6):732. Available from: http://archderm.jamanetwork.com/article.aspx?doi=10.1001/jamadermatol.2013.2874
51. Jennings L, Hambly R, Hughes R, Moriarty B, Kirby B. Metformin use in hidradenitis suppurativa. J Dermatolog Treat [Internet]. 2019 [cited 2019 Apr 3]; Available from: https://www.tandfonline.com/action/journalInformation?journalCode=ijdt20
52. Verdolini R, Clayton N, Smith A, Alwash N, Mannello B. Metformin for the treatment of hidradenitis suppurativa: a little help along the way. J Eur Acad Dermatology Venereol [Internet]. 2013 9 1 [cited 2019 Jan 2];27(9):1101–8. Available from: http://doi.wiley.com/10.1111/j.1468-3083.2012.04668.x
53. Golbari NM, Porter ML, Kimball AB, Stony Brook M, York N. Antiandrogen therapy with spironolactone for the treatment of hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 2019 [cited 2019 Jan 2];80(1):114–9. Available from: 10.1016/j.jaad.2018.06.063
54. Lee A, Fischer G. A case series of 20 women with hidradenitis suppurativa treated with spironolactone. Australas J Dermatol [Internet]. 2015 8 1 [cited 2019 Jan 2];56(3):192–6. Available from: http://doi.wiley.com/10.1111/ajd.12362
55. Jennings L, Nestor L, Molloy O, Hughes R, Moriarty B, Kirby B. The treatment of hidradenitis suppurativa with the glucagon-like peptide-1 agonist liraglutide. Br J Dermatol [Internet]. 2017 9 1 [cited 2019 Apr 3];177(3):858–9. Available from: http://doi.wiley.com/10.1111/bjd.15233
56. Khandalavala BN. A Disease-Modifying Approach for Advanced Hidradenitis Suppurativa (Regimen with Metformin, Liraglutide, Dapsone, and Finasteride): A Case Report. Case Rep Dermatol [Internet]. 2017 7 13 [cited 2019 Apr 3];9(2):70–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28868004
57. Huang CM, Kirchhof MG. A New Perspective on Isotretinoin Treatment of Hidradenitis Suppurativa: A Retrospective Chart Review of Patient Outcomes. Dermatology [Internet]. 2017 [cited 2018 Dec 11];233(2–3):120–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28641306
58. Davis SA, Lin H-C, Balkrishnan R, Feldman SR. Hidradenitis Suppurativa Management in the United States: An Analysis of the National Ambulatory Medical Care Survey and MarketScan Medicaid Databases. Ski appendage Disord [Internet]. 2015 9 [cited 2018 Dec 11];1(2):65–73. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27172455
59. Soria A, Canoui-Poitrine F, Wolkenstein P, Poli F, Gabison G, Pouget F, et al. Absence of Efficacy of Oral Isotretinoin in Hidradenitis Suppurativa: A Retrospective Study Based on Patients' Outcome Assessment. Dermatology [Internet]. 2009 [cited 2018 Dec 11];218:134–5. Available from: www.karger.com
60. Boer J, van Gemert M. Long-term results of isotretinoin in the treatment of 68 patients with hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 1999 [cited 2018 Dec 11];40(1):73–6. Available from: https://ac-els-cdn-com.proxy.library.emory.edu/S019096229970530X/1-s2.0-S019096229970530X-main.pdf?_tid=5a17b80a-4bd0-4cdc-a171-bb001bc5d3dc&acdnat=1544565867_18c2adf6335efbbc2fc9c6781016d4c5
61. Dicken CH, Powell ST, Spear KL. Evaluation of isotretinoin treatment of hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 1984 [cited 2018 Dec 11];11(3):500–2. Available from: https://ac-

els-cdn-com.proxy.library.emory.edu/S019096228470199X/1-s2.0-S019096228470199X-main.pdf?_tid=8bbff4ab-2dd6-4f14-927c-c10df800a070&acdnat=1544566323_f91dd7c7873d452f42659cc68f5fc40c

62. NORRIS JFB, CUNLIFFE WJ. Failure of treatment of familial widespread hidradenitis suppurativa with isotretinoin. Clin Exp Dermatol [Internet]. 1986 11 1 [cited 2018 Dec 11];11(6):579–83. Available from: http://doi.wiley.com/10.1111/j.1365-2230.1986.tb00512.x
63. Blok JL, van Hattem S, Jonkman MF, Horváth B. Systemic therapy with immunosuppressive agents and retinoids in hidradenitis suppurativa: a systematic review. Br J Dermatol [Internet]. 2013 2 1 [cited 2018 Dec 11];168(2):243–52. Available from: http://doi.wiley.com/10.1111/bjd.12104
64. Gallagher CG, Kirthi SK, Cotter CC, Revuz JR, Tobin AMT. Could isotretinoin flare hidradenitis suppurativa? A case series. Clin Exp Dermatol [Internet]. 2019 3 22 [cited 2019 Apr 3];ced.13944. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/ced.13944
65. Tan MG, Shear NH, Walsh S, Alhusayen R. Acitretin: Monotherapy or combined therapy for hidradenitis suppurativa? J Cutan Med Surg. 2017;21(1):48–53. [PubMed: 27432818]
66. Matusiak Ł, Bieniek A, Szepietowski JC. Acitretin treatment for hidradenitis suppurativa: a prospective series of 17 patients. Br J Dermatol [Internet]. 2014 7 1 [cited 2019 Jan 1];171(1):170–4. Available from: http://doi.wiley.com/10.1111/bjd.12884
67. Boer J, Nazary M. Long-term results of acitretin therapy for hidradenitis suppurativa. Is acne inversa also a misnomer? Br J Dermatol [Internet]. 2011 1 1 [cited 2019 Jan 1];164(1):170–5. Available from: http://doi.wiley.com/10.1111/j.1365-2133.2010.10071.x
68. Puri N, Talwar A. A study on the management of hidradenitis suppurativa with retinoids and surgical excision. Indian J Dermatol [Internet]. 2011;56(6):650. Available from: http://www.e-ijd.org/text.asp?2011/56/6/650/91821
69. Kimball AB, Okun MM, Williams DA, Gottlieb AB, Papp KA, Zouboulis CC, et al. Two Phase 3 Trials of Adalimumab for Hidradenitis Suppurativa. N Engl J Med [Internet]. 2016 [cited 2018 Nov 28];375(5):422–56. Available from: https://www.nejm.org/doi/pdf/10.1056/NEJMoa1504370
70. Miller I, Lynggaard CD, Lophaven S, Zachariae C, Dufour DN, Jemec GBE. A double-blind placebo-controlled randomized trial of adalimumab in the treatment of hidradenitis suppurativa. Br J Dermatol [Internet]. 2011 8 1 [cited 2018 Dec 5];165(2):391–8. Available from: http://doi.wiley.com/10.1111/j.1365-2133.2011.10339.x
71. Kimball AB, Kerdel F, Adams D, Mrowietz U, Gelfand JM, Gniadecki R, et al. Adalimumab for the Treatment of Moderate to Severe Hidradenitis Suppurativa. Ann Intern Med [Internet]. 2012 12 18 [cited 2018 Dec 5];157(12):846. Available from: http://annals.org/article.aspx?doi=10.7326/0003-4819-157-12-201212180-00004
72. Kimball AB, Sobell JM, Zouboulis CC, Gu Y, Williams DA, Sundaram M, 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 Dermatology Venereol. 2016;30(6):989–94.
73. Kimball AB, Sundaram M, Shields AL, Hudgens S, Okun M, Foley CM, et al. Adalimumab alleviates skin pain in patients with moderate-to-severe hidradenitis suppurativa: Secondary efficacy results from the PIONEER I and PIONEER II randomized controlled trials. J Am Dermatology [Internet]. 2018 [cited 2018 Dec 5];79:1141–3. Available from: 10.1016/j.jaad.2018.05.015
74. Argyropoulou M, Kanni T, Kyprianou M, Melachroinopoulos N, Giamarellos-Bourboulis EJ. Cost-savings of adalimumab in hidradenitis suppurativa: a retrospective analysis of a real-world cohort. Br J Dermatol [Internet]. 2018 11 4 [cited 2018 Dec 5]; Available from: http://doi.wiley.com/10.1111/bjd.17151
75. Zouboulis CC, Okun MM, Prens EP, Gniadecki R, Foley PA, Lynde C, et al. Long-term adalimumab efficacy in patients with moderate-to-severe hidradenitis suppurativa/acne inversa: 3-year results of a phase 3 open-label extension study. Venereol Allergol Immunol [Internet]. 2018 [cited 2018 Dec 5]; Available from: 10.1016/j.jaad.2018.05.040.
76. Liu M, Degner J, Davis JW, Idler KB, Nader A, Mostafa NM, et al. Identification of HLA-DRB1 association to adalimumab immunogenicity. 2018 [cited 2018 Dec 5]; Available from: 10.1371/journal.pone.0195325.t001

77. Patil S. Low-dose adalimumab biosimilar (ZRC-3197) in the treatment of hidradenitis suppurativa. Indian J Dermatol Venereol Leprol [Internet]. 2018 [cited 2019 Apr 3];84(6):745. Available from: http://www.ijdvl.com/text.asp?2018/84/6/745/242673

78. Jemec GBE, Okun MM, Forman SB, Gulliver WPF, Prens EP, Mrowietz U, et al. Adalimumab Medium-Term Dosing Strategy in Moderate-to-Severe Hidradenitis Suppurativa: Integrated Results from the Phase 3, Randomized, Placebo-Controlled, PIONEER Trials. Br J Dermatol [Internet]. 2019 3 27 [cited 2019 Apr 3];bjd.17919. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/bjd.17919

79. Humira (adalimumab) - Expanded indication [Internet]. RxNews. 2018 [cited 2019 Apr 24]. Available from: https://professionals.optumrx.com/content/dam/optum3/professional-optumrx/news/rxnews/clinical-updates/clinicalupdates_humira_2018-1018.pdf

80. Van Rappard DC, Leenarts MFE, Meijerink-Van 't Oost L, Mekkes JR, Meijerink-Van ' L, Oost T. Journal of Dermatological Treatment Comparing treatment outcome of infliximab and adalimumab in patients with severe hidradenitis suppurativa Comparing treatment outcome of infliximab and adalimumab in patients with severe hidradenitis suppurativa. J Dermatolog Treat [Internet]. 2012 [cited 2018 Dec 5];23:284–9. Available from: http://www.tandfonline.com/action/journalInformation?journalCode=ijdt20

81. Paradela S, Rodríguez-Lojo R, Fernández-Torres R, Arévalo P, Fonseca E. Long-term efficacy of infliximab in hidradenitis suppurativa. J Dermatolog Treat [Internet]. 2012 [cited 2018 Dec 5];23(4):278–83. Available from: http://www.tandfonline.com/action/journalInformation?journalCode=ijdt20

82. Oskardmay AN, Miles JA, Sayed CJ, Hill C, Carolina N. Determining the optimal dose of infliximab for treatment of hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 2019 [cited 2019 Jul 31]; Available from: 10.1016/j.jaad.2019.05.022

83. Montaudié H, Seitz-Polski B, Cornille A, Benzaken S, Lacour J-P, 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 [Internet]. 2016 [cited 2018 Dec 5];76(1):156–8. Available from: 10.1016/j.jaad.2016.07.024

84. Moots RJ, Xavier RM, Mok CC, Rahman MU, Tsai W-C, Al-Maini MH, et al. The impact of anti-drug antibodies on drug concentrations and clinical outcomes in rheumatoid arthritis patients treated with adalimumab, etanercept, or infliximab: Results from a multinational, real-world clinical practice, non-interventional study. PLoS One [Internet]. 2017 [cited 2018 Dec 5];12(4):e0175207. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28448562

85. Lesage C, Adnot-Desanlis L, Perceau G, Bonnet M, Palot J-P, Bernard P, et al. Efficacy and tolerance of prolonged infliximab treatment of moderate-to-severe forms of hidradenitis suppurativa. Eur J Dermatol [Internet]. [cited 2018 12 5];22(5):640–4. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22759562

86. Vossen ARJ V, Van Doorn BA, Van Der Zee HH, Prens EP. Apremilast for moderate hidradenitis suppurativa: Results of a randomized controlled trial. J Am Acad Dermatol [Internet]. 2019 [cited 2019 Jan 9];80(1):80–8. Available from: 10.1016/j.jaad.2018.06.046

87. Kerdel FR, Azevedo FA, Kerdel Don C, Don FA, Fabbrocini G, Kerdel FA. Apremilast for the Treatment of Mild-to-Moderate Hidradenitis Suppurativa in a Prospective, Open-Label, Phase 2 Study. J Drugs Dermatol [Internet]. 2019 2 1 [cited 2019 Apr 3];18(2):170–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30811140

88. Tzanetakou V, Kanni T, Giatrakou S, Katoulis A, Papadavid E, Netea MG, et al. Safety and Efficacy of Anakinra in Severe Hidradenitis Suppurativa. JAMA Dermatology [Internet]. 2016 1 1 [cited 2018 Dec 5];152(1):52. Available from: http://archderm.jamanetwork.com/article.aspx?doi=10.1001/jamadermatol.2015.3903

89. André R, Marescassier H, Gabay C, Pittet B, Laffitte E. Long-term therapy with anakinra in hidradenitis suppurativa in three patients. Int J Dermatol [Internet]. 2019 7 29 [cited 2019 Jul 31];ijd.14596. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/ijd.14596

90. Blok JL, Li K, Brodmerkel C, Horvátovich P, Jonkman MF, Horváth B. Ustekinumab in hidradenitis suppurativa: clinical results and a search for potential biomarkers in serum. Br J Dermatol [Internet]. 2016 4 1 [cited 2018 Dec 5];174(4):839–46. Available from: http://doi.wiley.com/10.1111/bjd.14338

91. Romaní J, Vilarrasa E, Martorell A, Fuertes I, Ciudad C, Molina-Leyva A. Ustekinumab with Intravenous Infusion: Results in Hidradenitis Suppurativa. Dermatology [Internet]. 2019 [cited 2019 Jul 31]; Available from: www.karger.com/drm

92. Adams DR, Yankura JA, Fogelberg AC, Anderson BE. Treatment of Hidradenitis Suppurativa With Etanercept Injection. Arch Dermatol [Internet]. 2010 5 1 [cited 2018 Dec 5];146(5):501–4. Available from: http://archderm.jamanetwork.com/article.aspx?doi=10.1001/archdermatol.2010.72

93. Lee RA, Dommasch E, Treat J, Sciacca-Kirby J, Chachkin S, Williams J, et al. A prospective clinical trial of open label etanercept for the treatment of hidradenitis suppurativa. [cited 2018 Dec 5]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2865694/pdf/nihms199046.pdf

94. Giamarellos-Bourboulis EJ, Pelekanou E, Antonopoulou A, Petropoulou H, Baziaka F, Karagianni V, et al. An open-label phase II study of the safety and efficacy of etanercept for the therapy of hidradenitis suppurativa. Br J Dermatol [Internet]. 2007 12 12 [cited 2018 Dec 5];158(3):567–72. Available from: http://doi.wiley.com/10.1111/j.1365-2133.2007.08372.x

95. Sotiriou E, Ioannidos Z. Etanercept for the Treatment of Hidradenitis Suppurativa. Acta Derm Venereol [Internet]. 2009 [cited 2018 Dec 5];89(1):82–3. Available from: https://medicaljournals.se/acta/content/abstract/10.2340/00015555-0545

96. Cusack C, Buckley C. Etanercept: effective in the management of hidradenitis suppurativa. Br J Dermatol [Internet]. 2006 1 16 [cited 2018 Dec 5];0(0):060116091018022. Available from: http://doi.wiley.com/10.1111/j.1365-2133.2005.07067.x

97. Pelekanou A, Kanni T, Savva A, Mouktaroudi M, Raftogiannis M, Kotsaki A, et al. Long-term efficacy of etanercept in hidradenitis suppurativa: results from an open-label phase II prospective trial. Exp Dermatol [Internet]. 2009 9 16 [cited 2018 Dec 5];19(6):538–40. Available from: http://doi.wiley.com/10.1111/j.1600-0625.2009.00967.x

98. Tursi A. Concomitant hidradenitis suppurativa and pyostomatitis vegetans in silent ulcerative colitis successfully treated with golimumab. Dig Liver Dis [Internet]. 2016 Dec [cited 2018 Dec 5];48(12):1511–2. Available from: 10.1016/j.dld.2016.09.011

99. van der Zee HH, Prens EP. Failure of anti-interleukin-1 therapy in severe hidradenitis suppurativa: a case report. Dermatology [Internet]. 2013 [cited 2018 Dec 5];226(2):97–100. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23713053

100. Frew JW, Hawkes JE, Krueger JG. A systematic review and critical evaluation of inflammatory cytokine associations in hidradenitis suppurativa. F1000Research [Internet]. 2018 [cited 2019 Mar 13];7:1930. Available from: 10.12688/f1000research.17267.1

101. Thorlacius L, Theut Riis P, Jemec GBE. Severe hidradenitis suppurativa responding to treatment with secukinumab: a case report. Br J Dermatol [Internet]. 2018 7 1 [cited 2018 Dec 5];179(1):182–5. Available from: http://doi.wiley.com/10.1111/bjd.15769

102. Schuch A, Fischer T, Boehner A, Biedermann T, Volz T. Successful treatment of severe recalcitrant hidradenitis suppurativa with the interleukin-17A antibody secukinumab. Acta Derm Venereol. 2018;98(1):151–2. [PubMed: 28902952]

103. Jørgensen A-HR, Yao Y, Thomsen SF. Therapeutic Response to Secukinumab in a 36-Year-Old Woman with Hidradenitis Suppurativa. Case Rep Dermatol Med [Internet]. 2018 [cited 2018 Dec 5];2018:8685136. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29850284

104. Giuseppe P, Nicola P, Valentina C, Elena C, Salvatrice C, Rosario G, et al. A Case of Moderate Hidradenitis Suppurativa and Psoriasis Treated with Secukinumab. Ann Dermatol [Internet]. 2018 8 1 [cited 2018 Dec 5];30(4):462. Available from: https://synapse.koreamed.org/DOIx.php?id=10.5021/ad.2018.30.4.462

105. Prussick L, Rothstein B, Joshipura D, Saraiya A, Turkowski Y, Abdat R, et al. Open-label, Investigator-Initiated, Single Site Exploratory Trial Evaluating Secukinumab, an anti IL17A monoclonal antibody, for Patients with Moderate-to-Severe Hidradenitis Suppurativa. Br J Dermatol [Internet]. 2019 2 22 [cited 2019 Apr 3]; Available from: http://doi.wiley.com/10.1111/bjd.17822

106. Casseres RG, Kahn JS, Her MJ, Rosmarin D. Guselkumab in the treatment of hidradenitis suppurativa: A retrospective chart review. J Am Acad Dermatol [Internet]. 2019;26(7):7–8. Available from: 10.1016/j.jaad.2018.12.017

107. Poveda I, Vilarrasa E, Martorell A, García-Martínez FJ, Segura JM, Hispán P, et al. Serum Zinc Levels in Hidradenitis Suppurativa: A Case–Control Study. Am J Clin Dermatol [Internet]. 2018 10 24 [cited 2019 Jan 26];19(5):771–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30043129

108. Brocard A, Knol A-C, Khammari A, Dréno B. Hidradenitis Suppurativa and Zinc: A New Therapeutic Approach. A Pilot Study. Dermatology [Internet]. 2007 [cited 2019 Jan 26];214:325–7. Available from: www.karger.com

109. 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 [Internet]. 2016 [cited 2019 Jan 26];84:197–202. Available from: 10.1016/j.jdermsci.2016.08.010

110. Salzman MB, Smith EM, Koo C. Excessive oral zinc supplementation. J Pediatr Hematol Oncol. 2002;24(7):582–4. [PubMed: 12368702]

111. de Brito NJN, Rocha ÉD, de Araújo Silva A, Costa JBS, França MC, das Graças Almeida M, et al. Oral zinc supplementation decreases the serum iron concentration in healthy schoolchildren: a pilot study. Nutrients [Internet]. 2014 9 4 [cited 2019 Jan 26];6(9):3460–73. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25192026

112. Armyra K, Kouris A, Markantoni V, Katsambas A, Kontochristopoulos G. Hidradenitis suppurativa treated with tetracycline in combination with colchicine: a prospective series of 20 patients. Int J Dermatol [Internet]. 2017 3 1 [cited 2018 Nov 21];56(3):346–50. Available from: http://doi.wiley.com/10.1111/ijd.13428

113. van der Zee HH, Prens EP. The Anti-Inflammatory Drug Colchicine Lacks Efficacy in Hidradenitis Suppurativa. Dermatology [Internet]. 2011 [cited 2019 Jan 26];223(2):169–73. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21997700

114. Anderson MD, Zauli S, Bettoli V, Boer J, Jemec GBE. Journal of Dermatological Treatment Cyclosporine treatment of severe Hidradenitis suppurativa-A case series. J Dermatolog Treat [Internet]. 2016 [cited 2019 Jan 26];27(3):247–50. Available from: https://www.tandfonline.com/action/journalInformation?journalCode=ijdt20

115. 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. Dermatologic Surg. 2009;35(8):1188–98.

116. 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):21–8. [PubMed: 20855672]

117. Hamzavi IH, Griffith JL, Riyaz F, Hessam S, Bechara FG. Laser and light-based treatment options for hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 2015 [cited 2018 Apr 1];73(5):s78–81. Available from: https://proxy.library.upenn.edu:2107/S0190962215019982/1-s2.0-S0190962215019982-main.pdf?_tid=3128ed96-4491-4b92-abd8-6fb22523a112&acdnat=1522593723_7f5fca2a6c454e9cce996ba6245ccc73

118. Mehdizadeh A, Hazen PG, Bechara FG, Zwingerman N, Moazenzadeh M, Bashash M, et al. Recurrence of hidradenitis suppurativa after surgical management: A systematic review and meta-analysis. J Am Acad Dermatol [Internet]. 2015 [cited 2018 Nov 28];73(5):S70–7. Available from: 10.1016/j.jaad.2015.07.044

119. Blok JL, Spoo JR, Leeman FWJ, Jonkman MF, Horváth B. Skin-Tissue-sparing Excision with Electrosurgical Peeling (STEEP): a surgical treatment option for severe hidradenitis suppurativa Hurley stage II/III. J Eur Acad Dermatology Venereol [Internet]. 2015 2 1 [cited 2019 Mar 31];29(2):379–82. Available from: http://doi.wiley.com/10.1111/jdv.12376

120. Martorell A, Giovanardi G, Gomez-Palencia P, Sanz-Motilva V. Defining Fistular Patterns in Hidradenitis Suppurativa. Dermatologic Surg [Internet]. 2019 3 18 [cited 2019 Mar 31];1. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30893168

121. EU Clinical Trials Register [Internet]. [cited 2019 Jun 5]. Available from: https://www.clinicaltrialsregister.eu/ctr-search/search

122. Hidradenitis suppurativa [Internet]. www.ClinicalTrials.Gov. 2019 [cited 2019 Apr 21]. Available from: https://clinicaltrials.gov/ct2/results?cond=hidradenitis+suppurativa&Search=Clear&age_v=&gndr=&type=&rslt=

123. Danesh MJ, Kimball AB. Pyrithione zinc as a general management strategy for hidradenitis suppurativa. J Am Acad Dermatol [Internet]. 2015 11 1 [cited 2018 Nov 21];73(5):e175. Available from: https://www-sciencedirect-com.proxy.library.emory.edu/science/article/pii/S0190962215019714

124. Scheinfeld N. Hidradenitis suppurativa: A practical review of possible medical treatments based on over 350 hidradenitis patients. Dermatol Online J [Internet]. 2013 4 15 [cited 2018 Nov 23];19(4):1. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24021361

125. Shirah BH, Shirah HA. Effective modified conservative tissue preserving protocol to treat stage I axillary hidradenitis suppurativa: a prospective cohort study of 627 patients with five years follow-up. J Dermatolog Treat [Internet]. 2017 7 4 [cited 2019 Mar 31];28(5):458–63. Available from: https://www.tandfonline.com/doi/full/10.1080/09546634.2016.1273470

126. Kaur MR, Lewis HM. Hidradenitis suppurativa treated with dapsone: A case series of five patients. J Dermatolog Treat [Internet]. 2006 [cited 2018 Nov 14];17(4):211–3. Available from: http://www.tandfonline.com/action/journalInformation?journalCode=ijdt20

127. Sayed C. A Randomized Controlled Trial Evaluating the Efficacy of Intralesional Triamcinolone in Hidradenitis suppurativa. ClinicalTrials.gov. 2018.

128. Moriarty B, Jiyad Z, Creamer D. Four-weekly infliximab in the treatment of severe hidradenitis suppurativa. Br J Dermatol [Internet]. 2014 4 1 [cited 2018 Dec 5];170(4):986–7. Available from: http://doi.wiley.com/10.1111/bjd.12713

129. Weber P, Morteza Seyed Jafari S, Yawalkar N, Hunger RE. Apremilast in the treatment of moderate to severe hidradenitis suppurativa: A case series of 9 patients. J Am Acad Dermatol [Internet]. 2017 [cited 2019 Jan 9];76(6):1189–91. Available from: 10.1016/j.jaad.2017.01.014

130. Provini LE, Stellar JJ, Stetzer MN, Nguyen PD, Jen M. Combination hyperbaric oxygen therapy and ustekinumab for severe hidradenitis suppurativa. Pediatr Dermatol [Internet]. 2019 2 25 [cited 2019 Apr 3]; Available from: http://doi.wiley.com/10.1111/pde.13775

131. Kovacs M, Podda M. Guselkumab in the treatment of severe hidradenitis suppurativa. J Eur Acad Dermatology Venereol [Internet]. 2019 3 18 [cited 2019 Apr 3];33(3):e140–1. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/jdv.15368

132. Nazary M, Prens EP, Boer J. Azathioprine lacks efficacy in hidradenitis suppurativa: a retrospective study of nine patients. Br J Dermatol [Internet]. 2016 3 1 [cited 2019 Jan 26];174(3):639–41. Available from: http://doi.wiley.com/10.1111/bjd.14086

133. Campanati A, Martina E, Giuliodori K, Bobyr I, Consales V, Offidani A. Two cases of Hidradenitis suppurativa and botulinum toxin type a therapy: A novel approach for a pathology that is still difficult to manage. Dermatol Ther [Internet]. 2019 2 10 [cited 2019 Apr 3];e12841. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30693648

134. Shi W, Schultz S, Strouse A, Gater DR. Successful treatment of stage III hidradenitis suppurativa with botulinum toxin A. BMJ Case Rep [Internet]. 2019 1 20 [cited 2019 Apr 3];12(1):e226064. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30665927

135. McPhie ML, Bridgman AC, Kirchhof MG. Combination Therapies for Hidradenitis Suppurativa: A Retrospective Chart Review of 31 Patients. J Cutan Med Surg [Internet]. 2019 [cited 2019 Jan 26];120347541882352. Available from: http://journals.sagepub.com/doi/10.1177/1203475418823529

136. Jemec GBE. Methotrexate is of limited value in the treatment of hidradenitis suppurativa. Clin Exp Dermatol. 2002;27(6):528–9. [PubMed: 12372104]

137. Ebell MH, Siwek J, Weiss BD, Woolf SH, Susman J, Ewigman B, et al. Strength of recommendation taxonomy (SORT): a patient-centered approach to grading evidence in the medical literature. Am Fam Physician [Internet]. 2004;69(3):548–56. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14971837

138. Mohd Mustapa MF, Exton LS, Bell HK, Ormerod AD, Hughes JR, Levell NJ, et al. Updated guidance for writing a British Association of Dermatologists clinical guideline: the adoption of the GRADE methodology 2016. Br J Dermatol [Internet]. 2017 1 1 [cited 2019 Apr 3];176(1):44–51. Available from: http://doi.wiley.com/10.1111/bjd.15201

139. CEBM. Oxford Centre for Evidence-based Medicine - Levels of Evidence (March 2009) [Internet]. Cebm. 2009. Available from: http://www.cebm.net/oxford-centre-evidence-based-

medicine-levels-evidence-march-2009/%5Cnhttp://files/1560/oxford-centre-evidence-based-medicine-levels-evidence-march-2009.html

140. 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. Lasers Med Sci. 2013;30(1):453–67. [PubMed: 24173910]
141. John H, Manoloudakis N, Sinclair JS. A systematic review of the use of lasers for the treatment of hidradenitis suppurativa. J Plast Reconstr aesthetic Surg [Internet]. 2016 [cited 2019 Jan 27];69:1374–81. Available from: 10.1016/j.bjps.2016.05.029
142. JY C. P7124: Long-pulsed alexandrite laser for treatment of hidradenitis suppurativa. In: Poster abstracts: American Academy of Dermatology 71st Annual Meeting [Internet]. 2013 [cited 2019 Mar 13]. p. AB224. Available from: https://ac-els-cdn-com.proxy.library.emory.edu/S0190962212022062/1-s2.0-S0190962212022062-main.pdf?_tid=7af414b0-fa11-4c79-9e03-c4e7b914d867&acdnat=1552487441_365d4b513acae349af1cda15d40244eb
143. Krakowski, Andrew C, Admani S, Uebelhoer NS, Eichenfield LF, Shumaker P. Residual Scarring From Hidradenitis Suppurativa: Fractionated CO 2 Laser as a Novel and Noninvasive Approach abstract. Pediatrics [Internet]. 2014 [cited 2019 Feb 2];133:e248–51. Available from: www.pediatrics.org/cgi/doi/10.1542/peds.2012-3356
144. Nicholson CL, Hamzavi I, Ozog DM. Rapid healing of chronic ulcerations and improvement in range of motion after fractional carbon dioxide (CO 2) treatment after CO 2 excision of hidradenitis suppurativa axillary lesions: A case report. JAAD Case Reports [Internet]. 2016 [cited 2019 Feb 2];2:4–6. Available from: 10.1016/j.jdcr.2015.11.001
145. Downs A. Journal of Cosmetic and Laser Therapy. J Cosmet Laser Ther [Internet]. 2004 [cited 2019 Mar 13];6:163–4. Available from: https://www.tandfonline.com/action/journalInformation?journalCode=ijcl20
146. Highton L, Chan WY, Khwaja N, Laitung JKG. Treatment of hidradenitis suppurativa with intense pulsed light: A prospective study. Plast Reconstr Surg. 2011;128(2):459–65. [PubMed: 21788837]
147. Piccolo D, Di Marcantonio D, Crisman G, Cannarozzo G, Sannino M, Chiricozzi A, et al. Unconventional use of intense pulsed light. Biomed Res Int [Internet]. 2014 9 3 [cited 2019 Mar 20];2014:618206. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25276803
148. Abdel Azim AA, Salem RT, Abdelghani R. Combined fractional carbon dioxide laser and long-pulsed neodymium : yttrium-aluminium-garnet (1064 nm) laser in treatment of hidradenitis suppurativa; a prospective randomized intra-individual controlled study. Int J Dermatol [Internet]. 2018 9 1 [cited 2019 Feb 2];57(9):1135–44. Available from: http://doi.wiley.com/10.1111/ijd.14075
149. Schweiger ES, Riddle CC, Aires DJ. Treatment of hidradenitis suppurativa by photodynamic therapy with aminolevulinic acid: preliminary results. J Drugs Dermatol [Internet]. 2011 4 [cited 2019 Feb 3];10(4):381–6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21455548
150. Mordon S. Treating hidradenitis suppurativa with photodynamic therapy. J Cosmet Laser Ther [Internet]. 2018 [cited 2019 Feb 3];20(4):223–8. Available from: https://www.tandfonline.com/action/journalInformation?journalCode=ijcl20
151. Gold M, Bridges TM, Bradshaw VL, Boring M. ALA-PDT and blue light therapy for hidradenitis suppurativa. J drugs dermatology [Internet]. 2004 [cited 2019 Mar 13];3(1 Suppl):S32–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14964759
152. Gold MH. Aminolevulinic Acid Photodynamic Therapy for Hidradenitis Suppurativa. Dermatol Clin [Internet]. 2007 [cited 2019 Mar 20];25:67–73. Available from: https://ac-els-cdn-com.proxy.library.emory.edu/S0733863506000908/1-s2.0-S0733863506000908-main.pdf?_tid=7ec6919f-8f39-4d71-8096-37ca6e7b3b94&acdnat=1553093230_c72ce2e7fe208e0eb982ceea4b91d4a8
153. Agut-Busquet E, Romaní J, Gilaberte Y, García-Malinis 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 [Internet]. 2016 [cited 2019 Mar 13];15:1020–8. Available from: www.rsc.org/pps

154. 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 Exp Dermatol [Internet]. 2015 3 1 [cited 2019 Mar 13];40(2):116–22. Available from: http://doi.wiley.com/10.1111/ced.12459

155. Jesús M, Valladares S, Salvado NE, Angel M, Prieto R. Treatment of hidradenitis suppurativa with intralesional photodynamic therapy with 5-aminolevulinic acid and 630 nm laser beam. J Dermatol Sci [Internet]. 2017 [cited 2019 Mar 13];85:241–6. Available from: 10.1016/j.jdermsci.2016.12.014

156. Valladares-Narganes LM, Rodríguez-Prieto MA, Blanco-Suárez MD, Rodriguez-Lage C, García-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 [Internet]. 2015 4 1 [cited 2019 Mar 13];172(4):1136–9. Available from: http://doi.wiley.com/10.1111/bjd.13385

157. Andino Navarrete R, Hasson Nisis A, Parra Cares J. Effectiveness of 5-aminolevulinic acid photodynamic therapy in the treatment of hidradenitis suppurativa: a report of 5 cases. Actas Dermosifiliogr [Internet]. 2014 7 [cited 2019 Mar 13];105(6):614–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24472519

158. Sotiriou E, Apalla Z, Maliamani F, Ioannides D. Treatment of recalcitrant hidradenitis suppurativa with photodynamic therapy: report of five cases. Clin Exp Dermatol [Internet]. 2009 10 1 [cited 2019 Mar 13];34(7):e235–6. Available from: http://doi.wiley.com/10.1111/j.1365-2230.2008.03094.x

159. 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 [Internet]. 2005 4 1 [cited 2019 Mar 13];152(4):803–4. Available from: http://doi.wiley.com/10.1111/j.1365-2133.2005.06475.x

160. Passeron T, Khemis A, Ortonne J-P. Pulsed dye laser-mediated photodynamic therapy for acne inversa is not successful: A pilot study on four cases. J Dermatolog Treat [Internet]. 2009 1 18 [cited 2019 Mar 20];20(5):297–8. Available from: http://www.tandfonline.com/doi/full/10.1080/09546630902882063

161. Luo D, Tan Y, Cheng Q, Wu J, Lei X. Photodynamic therapy combined with surgery for Hidradenitis Suppurativa: A case report Photodynamic therapy combined with surgery for Hidradenitis Suppurativa: A case report. Photodiagnosis Photodyn Ther [Internet]. 2019 [cited 2019 Jul 31]; Available from: 10.1016/j.pdpdt.2019.07.024

162. Fröhlich D, Baaske D, Glatzel M. [Radiotherapy of hidradenitis suppurativa--still valid today?]. Strahlenther Onkol [Internet]. 2000 6 [cited 2019 Mar 20];176(6):286–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10897256

163. Trobetta M, Werts ED PD. The role of radiotherapy in the treatment of hidradenitis suppurativa: Case report and review of the literature. Dermatol Online J [Internet]. 2010 [cited 2019 Mar 20];16(2). Available from: https://escholarship.org/uc/item/0jj6w1dt

164. Haber R, Gottlieb J, Zagdanski A-M, Battistella M, Bachelez H. Radiation-induced hidradenitis suppurativa: A case report. JAAD Case Reports [Internet]. 2017 [cited 2019 Mar 20];3(3):182–4. Available from: 10.1016/j.jdcr.2017.02.013

165. Maher M, Larsen L, California S. CASE REPORT A case of radiation-induced localized exacerbation of hidradenitis suppurativa. JAAD Case Reports [Internet]. 2016 [cited 2019 Mar 20];2(1):44–6. Available from: 10.1016/j.jdcr.2015.11.009

166. Iwasaki J, Marra DE, Fincher EF, Moy RL. Treatment of hidradenitis suppurativa with a nonablative radiofrequency device. Dermatologic Surg [Internet]. 2008 12 5 [cited 2019 Mar 20];34(1):114–7. Available from: http://doi.wiley.com/10.1111/j.1524-4725.2007.34025.x

167. Gys B, De Hous N, Hubens G, De Win G, Komen N. Fistula-tract Laser Closure (FiLaCTM) for complex urethroperineal fistula. Acta Chir Belg [Internet]. 2018;118(6):398–401. Available from: 10.1080/00015458.2018.1515337

168. RJV Vossen A, APC van Huijkelom MB, Nijsten TE, Bakker EW, van der Zee HH, van Doorn MB, et al. Aggravation of mild axillary hidradenitis suppurativa by microwave ablation: Results of a randomized intrapatient–controlled trial. J Am Acad Dermatol [Internet]. 2018 [cited 2019 Mar 20];80(3):777–9. Available from: 10.1016/j.jaad.2018.06.019

169. Huang A, Lindgren A, Krempa M, Hui A. Hidradenitis Suppurativa-Like Condition Occurring After Microwave Sweat Gland Ablation. Dermatol Surg [Internet]. 2018 11 [cited 2019 Mar 20];44(11):1472–5. Available from: http://insights.ovid.com/crossref?an=00042728-201811000-00022

170. Kohorst JJ, Baum CL, Otley CC, Roenigk RK, Schenck LA, Pemberton JH, et al. Surgical Management of Hidradenitis Suppurativa: Outcomes of 590 Consecutive Patients. Dermatologic Surg. 2016;42(9):1030–40.

171. Ritz J-P, Runkel N, Haier J, Buhr HJ. Extent of surgery and recurrence rate of hidradenitis suppurativa. Int J Colorectal Dis [Internet]. 1998 [cited 2019 Mar 31];13(4):164. Available from: http://link.springer.com/10.1007/s003840050159

172. 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 [Internet]. 2010 [cited 2019 Jan 27];63(3):475–80. Available from: https://ac-els-cdn-com.proxy.library.emory.edu/S0190962209022889/1-s2.0-S0190962209022889-main.pdf?_tid=5e2f95b5-86fe-4c15-a931-1698b148e09f&acdnat=1548602454_ff289af25ace29d156e34221f7ae158b

173. Jain A, Jain V. Use of lasers for the management of refractory cases of hidradenitis suppurativa and pilonidal sinus. J Cutan Aesthet Surg [Internet]. 2012;5(3):190. Available from: http://www.jcasonline.com/text.asp?2012/5/3/190/101377

174. van Hattem S, Spoo JR, Horváth B, Jonkman MF, Leeman FWJ. Surgical Treatment of Sinuses by Deroofing in Hidradenitis Suppurativa. Dermatologic Surg [Internet]. 2012 3 1 [cited 2019 Mar 20];38(3):494–7. Available from: http://insights.ovid.com/crossref?an=00042728-201203000-00022

175. Dahmen RA, Gkalpakiotis S, Mardesicova L, Arenberger P, Arenbergerova M. Deroofing followed by thorough sinus tract excision: a modified surgical approach for hidradenitis suppurativa. J der Dtsch Dermatologischen Gesellschaft [Internet]. 2019 7 20 [cited 2019 Jul 31];17(7):698–702. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/ddg.13875

176. Blok JL, Boersma M, Terra JB, Spoo JR, Leeman FWJ, van den Heuvel ER, et al. Surgery under general anaesthesia in severe hidradenitis suppurativa: a study of 363 primary operations in 113 patients. J Eur Acad Dermatology Venereol [Internet]. 2015 8 1 [cited 2019 Jan 27];29(8):1590–7. Available from: http://doi.wiley.com/10.1111/jdv.12952

177. Janse I, Hellinga J, Blok J, Heuvel E, Spoo J, Jonkman M, et al. Skin-Tissue-sparing Excision with Electrosurgical Peeling: A Case Series in Hidradenitis Suppurativa. Acta Derm Venereol [Internet]. 2016 3 [cited 2019 Mar 20];96(3):390–1. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26463363

178. Aksakal AB, Adişen E. Hidradenitis suppurativa: Importance of early treatment; efficient treatment with electrosurgery. Dermatologic Surg [Internet]. 2008 12 17 [cited 2019 Mar 20];34(2):228–31. Available from: http://doi.wiley.com/10.1111/j.1524-4725.2007.34042.x

179. Alharbi Z, Kauczok J, Pallua N. A review of wide surgical excision of hidradenitis suppurativa. BMC Dermatol [Internet]. 2012 [cited 2019 Mar 20];12(9). Available from: http://www.biomedcentral.com/1471-5945/12/9

180. Kagan RJ, Yakuboff KP, Warner P, Warden GD. Surgical treatment of hidradenitis suppurativa: A 10-year experience. Surgery [Internet]. [cited 2019 Mar 31];138(4):734–41. Available from: https://pdf.sciencedirectassets.com/272584/1-s2.0-S0039606005X05761/1-s2.0-S0039606005004344/main.pdf?x-amz-security-token=AgoJb3JpZ2luX2VjEMD%2F%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJHMEUCICJ3emgT9KutzZx8iAASdEg%2F%2BkFDjQYBee6ug6wWoOCbAiEA1dUd5hJQ

181. Bordier-Lamy F, Palot J-P, Vitry F, Bernard P, Grange F. Maladie de Verneuil : étude rétrospective chez 93 malades traités chirurgicalement. Ann Dermatol Venereol [Internet]. 2008 5 [cited 2019 Mar 31];135(5):373–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18457723

182. Nweze N, Parsikia A, Ahuja R, Joshi ART. Axillary Hidradenitis: Risk Factors for Recurrence after Surgical Excision in 214 Patients. Am Surg [Internet]. 2018 3 1 [cited 2019 Mar 31];84(3):422–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29559059

183. Soldin MG, Tulley P, Kaplan H, Hudson DA, Grobbelaar AO. Chronic axillary hidradenitis - The efficacy of wide excision and flap coverage. Br J Plast Surg [Internet]. 2000 [cited 2019 Mar

31];53(5):434–6. Available from: https://pdf.sciencedirectassets.com/272557/1-s2.0-S0007122600X00094/1-s2.0S000712269993285X/main.pdf?x-amz-security-token=AgoJb3JpZ2luX2VjEMD%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJIMEYCIQDGhsFZV WYh4pRGTE4E%2F2xe0MwyFpjnEZ9uBm2shWG3%2FwIhAIEY05mQ

184. Menderes A, Sunay O, Vayvada H, Yilmaz M. Surgical management of hidradenitis suppurativa. Int J Med Sci [Internet]. 2010 7 19 [cited 2019 Mar 31];7(4):240–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20714346

185. Posch C, Monshi B, Quint T, Vujic I, Lilgenau N, Rappersberger K, et al. 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 [Internet]. 2017 [cited 2018 Apr 1];77:123–9. Available from: https://proxy.library.upenn.edu:2300/service/content/pdf/watermarked/1-s2.0-S0190962217301494.pdf?locale=en_US

186. Rompel R, Petres J. Long-term results of wide surgical excision in 106 patients with hidradenitis suppurativa. Dermatol Surg [Internet]. 2000 7 [cited 2019 Mar 31];26(7):638–43. Available from: http://www.ncbi.nlm.nih.gov/pubmed/10886270

187. Tanaka A, Hatoko M, Tada H, Kuwahara M, Mashiba K, Yurugi S. Experience with surgical treatment of hidradenitis suppurativa. Ann Plast Surg [Internet]. 2001 12 [cited 2019 Mar 31];47(6):636–42. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11756834

188. Harrison BJ, Mudge M. Recurrence after surgical treatment of hidradenitis suppurative. Br Med J [Internet]. 1987 [cited 2019 Mar 31];294(6570):487–9. Available from: https://search-proquest-com.proxy.library.emory.edu/docview/1776480806?accountid=10747

189. Bieniek A, Matusiak Łu, Okulewicz-Gojlik D, Szepietowski JC. Surgical Treatment of Hidradenitis Suppurativa: Experiences and Recommendations. Dermatologic Surg [Internet]. 2010 12 1 [cited 2019 Mar 31];36(12):1998–2004. Available from: http://insights.ovid.com/crossref?an=00042728-201012000-00015

190. BÜYÜKAŞIK O, HASDEMIR AO, KAHRAMANSOY N, ÇÖL C, ERKOL H. Surgical Approach to Extensive Hidradenitis Suppurativa. Dermatologic Surg [Internet]. 2011 6 1 [cited 2019 Mar 31];37(6):835–42. Available from: http://doi.wiley.com/10.1111/j.1524-4725.2011.01961..x

191. 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. Int J Dermatol [Internet]. 2017 1 1 [cited 2019 Mar 31];56(1):109–15. Available from: http://doi.wiley.com/10.1111/ijd.13393

192. Walter AC, Meissner M, Kaufmann R, Valesky E, Pinter A. Hidradenitis Suppurativa After Radical Surgery-Long-Term Follow-up for Recurrences and Associated Factors. Dermatol Surg. 2018;44(10):1323–31. [PubMed: 30204742]

193. Mikkelsen PR, Dufour DN, Zarchi K, Jemec GBE. Recurrence rate and patient satisfaction of CO2laser evaporation of lesions in patients with hidradenitis suppurativa: A retrospective study. Dermatologic Surg. 2015;41(2):255–60.

194. Finley EM, Louis Ratz J, Orleans N. Treatment of hidradenitis suppurativa with carbon dioxide laser excision and second-intention healing. J Am Acad Dermatol [Internet]. 1996 [cited 2019 Mar 31];34(3):465–9. Available from: https://pdf.sciencedirectassets.com/272892/1-s2.0-S0190962200X01338/1-s2.0-S0190962296904417/main.pdf?x-amz-security-token=AgoJb3JpZ2luX2VjEL%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJHMEUCIQCd4E3 1aZI6nUVtfa0VMaNTZ2bKBiSe4ymD9BwtO6kpHgIgPpHRiJQtlb

195. 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 [Internet]. 2002 [cited 2019 Mar 31];47(2):280–5. Available from: https://pdf.sciencedirectassets.com/272892/1-s2.0-S0190962200X00370/1-s2.0-S0190962202000592/main.pdf?x-amz-security-token=AgoJb3JpZ2luX2VjEL%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJIMEYCIQC66JfIvl GHBttj9v96NO0nj4dX4UQ%2F%2FwWLTvpuxp9a2AIhAPJ5rY

196. 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 [Internet]. 2008 12 1 [cited 2019 Mar 31];159(6):1309–14. Available from: http://doi.wiley.com/10.1111/j.1365-2133.2008.08932.x

197. Grimstad Ø, Tzellos T, Dufour DN, Bremnes Ø, Skoie IM, Snekvik I, et al. Evaluation of medical and surgical treatments for hidradenitis suppurativa using real-life data from the Scandinavian registry (HISREG). J Eur Acad Dermatology Venereol [Internet]. 2019 4 [cited 2019 Apr 3];jdv.15353. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/jdv.15353

198. Pagliarello C, Fabrizi G, Feliciani C, Di Nuzzo S. Cryoinsufflation for Hurley Stage II Hidradenitis Suppurativa. JAMA Dermatology [Internet]. 2014 7 1 [cited 2019 Mar 31];150(7):765. Available from: http://archderm.jamanetwork.com/article.aspx?doi=10.1001/jamadermatol.2014.430

199. Pagliarello C, Fabrizi G, di Nuzzo S. Cryoinsufflation for Hidradenitis Suppurativa: Technical Refinement to Prevent Complications. Dermatol Surg. 2016;42(1):130–2. [PubMed: 26716713]

200. Bong JL, Shalders K, Saihan E. Treatment of persistent painful nodules of hidradenitis suppurativa with cryotherapy. Clin Exp Dermatol [Internet]. 2003 5 1 [cited 2019 Mar 31];28(3):241–4. Available from: http://doi.wiley.com/10.1046/j.1365-2230.2003.01238.x

201. Molina-Leyva A, Salvador-Rodriguez L, Martinez-Lopez A, Cuenca-Barrales C. Effectiveness, safety and tolerability of drainage and punch-trocar-assisted cryoinsufflation (cryopunch) in the treatment of inflammatory acute fluid collections in hidradenitis suppurativa patients. J Eur Acad Dermatology Venereol. 2019;1–2.

202. Deckers IE, Dahi Y, van der Zee HH, Prens EP. Hidradenitis suppurativa treated with wide excision and second intention healing: a meaningful local cure rate after 253 procedures. J Eur Acad Dermatology Venereol [Internet]. 2018 3 1 [cited 2019 Mar 31];32(3):459–62. Available from: http://doi.wiley.com/10.1111/jdv.14770

203. 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 Aesthetic Surg [Internet]. 2016 [cited 2019 Mar 31];69:554–6. Available from: 10.1016/j.bjps.2015.12.0041748-6815/a

204. Burney RE. 35-Year Experience with Surgical Treatment of Hidradenitis Suppurativa. World J Surg [Internet]. 2017 11 13 [cited 2019 Mar 31];41(11):2723–30. Available from: http://link.springer.com/10.1007/s00268-017-4091-7

205. Balik E, Eren T, Bulut T, Büyükuncu Y, Bugra D, Yamaner S. Surgical Approach to Extensive Hidradenitis Suppurativa in the Perineal/Perianal and Gluteal Regions. World J Surg [Internet]. 2009 3 6 [cited 2019 Mar 31];33(3):481–7. Available from: http://link.springer.com/10.1007/s00268-008-9845-9

206. Bieniek A, Matusiak, 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 Dermatology Venereol. 2013;27(8):1015–21.

207. van Rappard DC, Mooij JE, Mekkes JR. Mild to moderate hidradenitis suppurativa treated with local excision and primary closure. J Eur Acad Dermatology Venereol [Internet]. 2012 7 1 [cited 2019 Mar 31];26(7):898–902. Available from: http://doi.wiley.com/10.1111/j.1468-3083.2011.04203.x

208. BUIMER MG, ANKERSMIT MFP, WOBBES T, KLINKENBIJL JHG. Surgical Treatment of Hidradenitis Suppurativa with Gentamicin Sulfate: A Prospective Randomized Study. Dermatologic Surg [Internet]. 2007 12 17 [cited 2019 Mar 31];34(2):224–7. Available from: http://doi.wiley.com/10.1111/j.1524-4725.2007.34041.x

209. Wormald JCR, Balzano A, Clibbon JJ, Figus A. Surgical treatment of severe hidradenitis suppurativa of the axilla: Thoracodorsal artery perforator (TDAP) flap versus split skin graft. Br J Plast Surg [Internet]. 2014 [cited 2019 Mar 31];67:1118–24. Available from: 10.1016/j.bjps.2014.04.032

210. Laredo Ortiz C, López Castillo V, Solesio Pilarte F, Lorda Barraguer E. Experience Using the Thoracodorsal Artery Perforator Flap in Axillary Hidradentitis Suppurativa Cases. Aesthetic Plast Surg [Internet]. 2010 12 30 [cited 2019 Mar 31];34(6):785–92. Available from: http://link.springer.com/10.1007/s00266-010-9544-4

211. Egemen O, Özkaya Ö, Bingöl D, Orman Ç, Akan M. Islanded Perforator Flaps in the Reconstruction of Hidradenitis Suppurativa Defects. J Reconstr Microsurg [Internet]. 2013 [cited 2019 Mar 31];29:297–302. Available from: http://dx.doi.org/

212. Altmann S, Fansa H, Schneider W. Axillary Hidradenitis Suppurativa: A Further Option for Surgical Treatment. J Cutan Med Surg [Internet]. 2004 [cited 2019 Mar 31];8(1):6–10. Available from: https://journals-sagepub-com.proxy.library.emory.edu/doi/pdf/10.1177/120347540400800102

213. Unal C, Yirmibesoglu OA, Ozdemir J, Hasdemir M. Superior and inferior gluteal artery perforator flaps in reconstruction of gluteal and perianal/perineal hidradenitis suppurativa lesions. Microsurgery [Internet]. 2011 10 1 [cited 2019 Mar 31];31(7):539–44. Available from: http://doi.wiley.com/10.1002/micr.20918

214. Elgohary H, Nawar AM, Zidan A, Shoulah AA, Younes MT, Hamed AM. Outcome of Pedicled Thoracodorsal Artery Perforator Flap in the Surgical Treatment of Stage II and III Hidradenitis Suppurativa of Axilla. Ann Plast Surg [Internet]. 2018 12 [cited 2019 Mar 31];81(6):688–93. Available from: http://insights.ovid.com/crossref?an=00000637-201812000-00015

215. Mandal A, Watson J. Experience with different treatment modules in hidradenitis suppuritiva: A study of 106 cases [Internet]. Vol. 3, The Surgeon. 2005 [cited 2019 Mar 31]. Available from: https://pdf.sciencedirectassets.com/279352/1-s2.0-S1479666X05X80015/1-s2.0-S1479666X0580006X/main.pdf?x-amz-security-token=AgoJb3JpZ2luX2VjEML%2F%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJHMEUCIHV5h1BDZ7NNPbR6Hb3gSN5zT%2FSzi9vRB4OOc2tqU67PAiEA%2FbT292BgoSWObTgNhxDOZ9rM3o6dJb1%2Ffxa9Asfyc2Aq2gMIehACGgwwNTkwMDM1NDY4NjUiDCHKU%2F85TpbDzAbdeSq3A9TMcwEL9dF7k74GhTOauK9BiNUlbZ7st3NF2CQbFpSmHHdvQUT7mCNED1d0ddtBuqw1Osy5A8A1mp37pB%2BtRhwRVIyEXwhcXhGO9Q%2BZYGBQfQhbdfkqzulXmDLoyfWxrUvGxVv31nK6Ggh03EDopUlNLGBKcogdXUa2BfmaIgcvyJ%2Fz3eAMFhTJVFaADgbfB2c0QLtZc%2B4EqTKCme9ExWNfrnSJ6GkyIC9gEfl8TIDABrvfllS0Q%2F35b10Bw2pCoSe2jUEIsDCPY3lWbjwJQcbieTMEk%2BfIX1yPMcSOiWw%2Bjk91FZ5viTo6x%2BXYD%2Bdxu3DybU9itT%2BquNl%2FhhUMddQyP4dLmaJoUFf886IwB5kazCrH6ssOMVlkMIBe%2BQt5CXLoxKRBxWeI%2F7ZOFApwbe9GQTI1r9MXcc5c2ihxbXX4ZLhDV3VudJFFAkY4QQYKFUFS5eW79dQMOjEyTHFRw%2BZ9E4zPVRoskeBA3SzCRyIp6e4EMo3w2YHLbxrREvp7ZkIjySRCE6Dr%2BApQsc%2F4EUtmIPmNuAEmYGncsZIWUuJbak8zdDY8e2D2SJ1zPSpKRl6cv3JJWbYwi%2B6D5QU6tAFwdt8KuilTUC6sVF32yyB1DCk%2BraLHrh2edyODjlQqa5qQv5TMTSTPjaoJHjTuQvWbhZMzNc3eH3Vc6%2BrtOXFl%2BB7bja%2BtuNiYuebEcSre8W5v358DgL724HYFB%2Fi8tfi88zh%2F49F7dkQeSS82gvM0o8Vtu1GsE%2BIPF3HHyjJnzGKTyPvSQ%2F%2Fh7GhxbEUjYE11RFeCwWwnSAjUBtmXn9IipNwwAUp1xhwBYYteiTCfDRMQAU0%3D&AWSAccessKeyId=ASIAQ3PHCVTYVYJRJH4K&Expires=1554056975&Signature=3eWj0jlRZgxdZs8V%2BtQHSDAPtkU%3D&hash=55dedfcfd7bc89f99018f0800b7a984802268c809bc476450eef732353914c1e&host=68042c943591013ac2b2430a89b270f6af2c76d8dfd086a07176afe7c76c2c61&pii=S1479666X0580006X&tid=spdf-f0f5626b-e8b7-43e8-9e3c-5bcd1a726beb&sid=777156a25ea5e74f1a19ede513043ec22066gxrqa&type=client

216. Bocchini SF, Habr-Gama A, Kiss DR, Imperiale AR, Araujo SEA. Gluteal and Perianal Hidradenitis Suppurativa. Dis Colon Rectum [Internet]. 2003 7 [cited 2019 Mar 31];46(7):944–9. Available from: https://insights.ovid.com/crossref?an=00003453-200346070-00015

217. Maeda T, Kimura C, Murao N, Takahashi K. Promising long-term outcomes of the reused skin-graft technique for chronic gluteal hidradenitis suppurativa. Br J Plast Surg [Internet]. 2015 [cited 2019 Mar 31];68:1268–75. Available from: 10.1016/j.bjps.2015.05.0251748-6815/a

218. Romanowski KS, Fagin A, Werling B, Kass G, Liao J, Granchi T, et al. Surgical Management of Hidradenitis Suppurativa. J Burn Care Res [Internet]. 2017 11 1 [cited 2019 Mar 31];38(6):365–70. Available from: https://academic.oup.com/jbcr/article/38/6/365-370/4773997

219. Bohn J, Svensson H. Surgical treatment of hidradenitis suppurativa. Scand J Plast Reconstr Surg Hand Surg [Internet]. 2001 [cited 2019 Mar 31];35(3):305–9. Available from: https://www.tandfonline.com/action/journalInformation?journalCode=iphs20

220. 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):1385–8. [PubMed: 15809603]

221. Nicoli F, Balzani A, Lazzeri D, Gentile P, Chilgar RM, Di Pasquali C, et al. Severe hidradenitis suppurativa treatment using platelet-rich plasma gel and Hyalomatrix. Int Wound J [Internet]. 2015 6 1 [cited 2019 Mar 31];12(3):338–43. Available from: http://doi.wiley.com/10.1111/iwj.12117

222. Defazio MV, Economides JM, King KS, Han KD, Shanmugam VK, Attinger CE, et al. Outcomes after Combined Radical Resection and Targeted Biologic Therapy for the Management of Recalcitrant Hidradenitis Suppurativa. Ann Plast Surg. 2016;77(2):217–22. [PubMed: 26559649]

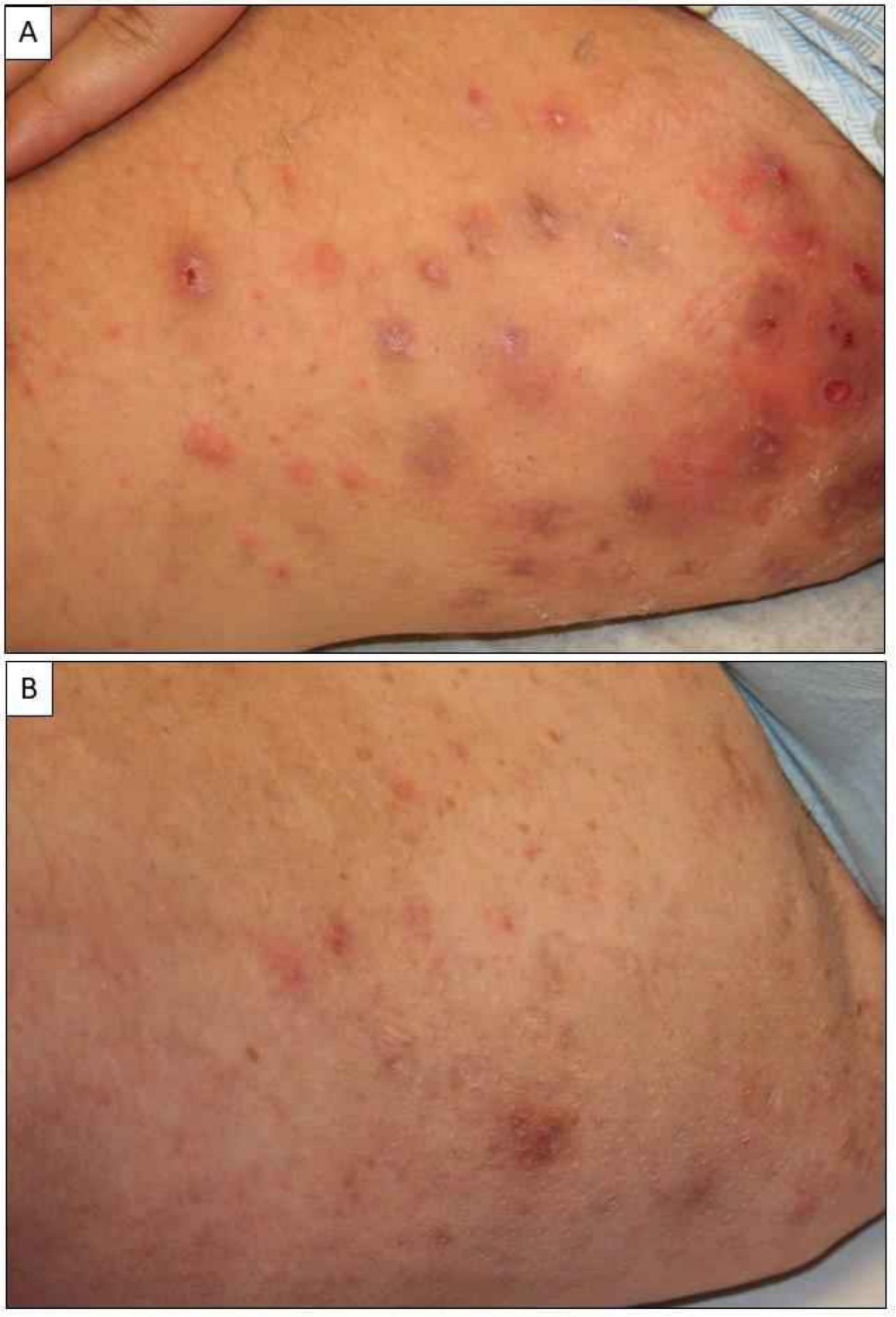

Figure 1:

Treatment of inguinal HS using Nd:YAG laser

(A) Right medial thigh prior to treatment.

(B) Right medial thigh following 3 treatments.

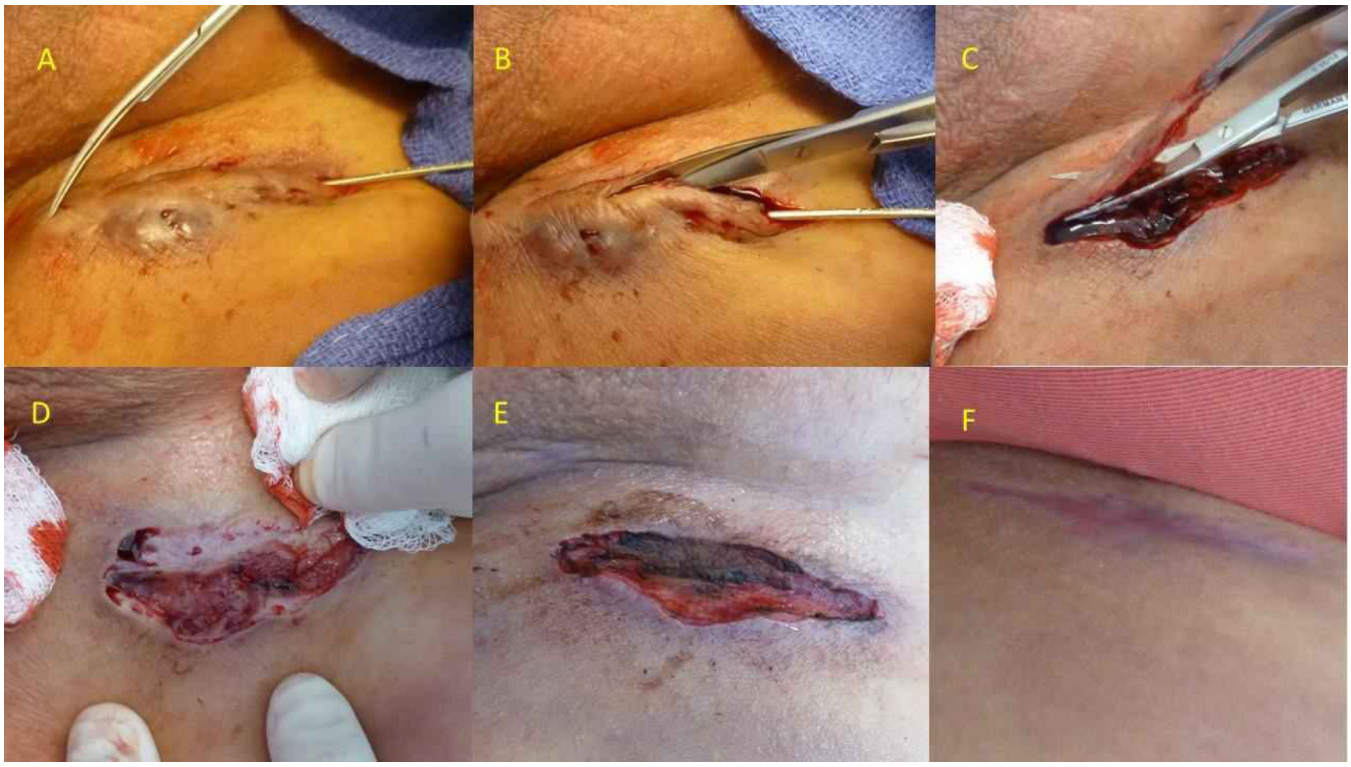

Figure 2 –.

Deroofing technique

(A) Following local anesthesia, a double-ended fistula probe is used to delineate extent of a well-demarcated cutaneous sinus.

(B) Iris scissor used over top of the probe to open the sinus.

(C) Removal of tissue overlying the sinus to create a beveled edge.

(D) The dermal base of the sinus tract is left intact after probing reveals no lateral extension. To ensure that the floor of the sinus tract remains intact, contents of the sinus tract should be removed using gentle debridement or gauze grattage.

(E) Wound after hemostasis using aluminum chloride solution and electrocautery.

(F) Healed wound 5 weeks after deroofing.

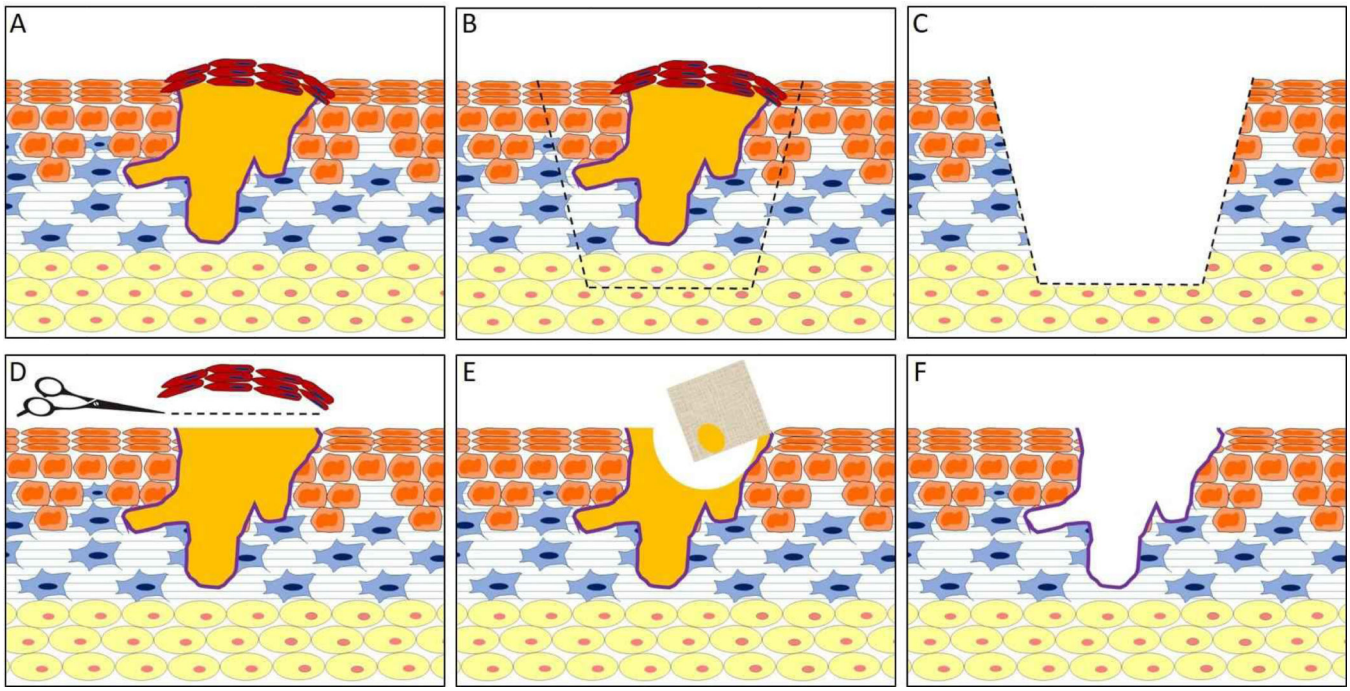

Figure 3 -

Comparison of sinus tract removal by excision vs deroofing technique

(A) Cross sectional view of sinus tract prior to intervention. This sinus tract extends through the reticular dermis and closely approaches the subcutaneous fat. The base/floor of the sinus tract is outlined in purple, and the epithelium on the roof/top of the sinus tract is red.

(B) Excision - The borders of the entire sinus tract are outlined clinically and excision is extended to the subcutaneous fat. Intraoperative fistula probe is used to detect any additional interconnecting tracts, and the margins are extended laterally if appropriate.

(C) Excision - Surgical defect after excision. Note, the base of the sinus tract is completely removed in HS sinus tract excision.

(D) Deroofing -Scissors are used to remove the epithelium overlying the sinus tract.

(E) Deroofing - After the entire roof of the sinus tract is removed and probing reveals no further extension, gelatinous material is removed from sinus tract using gentle gauze grattage. Rough debridement may result in defects in the floor of the sinus tract, which prolongs healing time.

(F) Deroofing - Surgical defect after deroofing. The epithelium at the base of the sinus tract, marked in purple, remains intact.

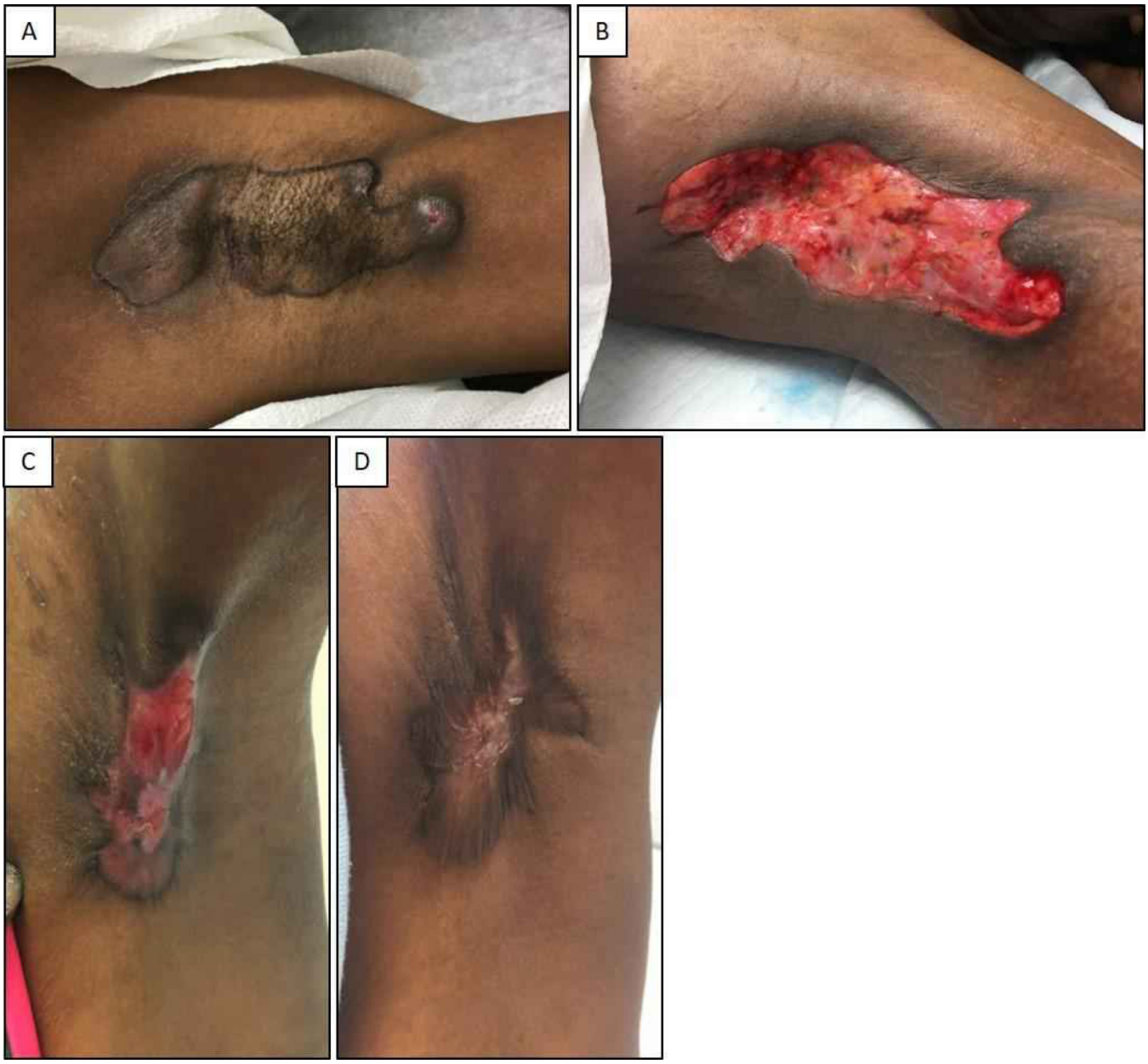

Figure 4:

Wound healing following surgical excision of HS sinus tract

(A) Prior to excision, (B) Post-operative day 4, (C) Post-operative week 6, and (D) Post-operative month 4

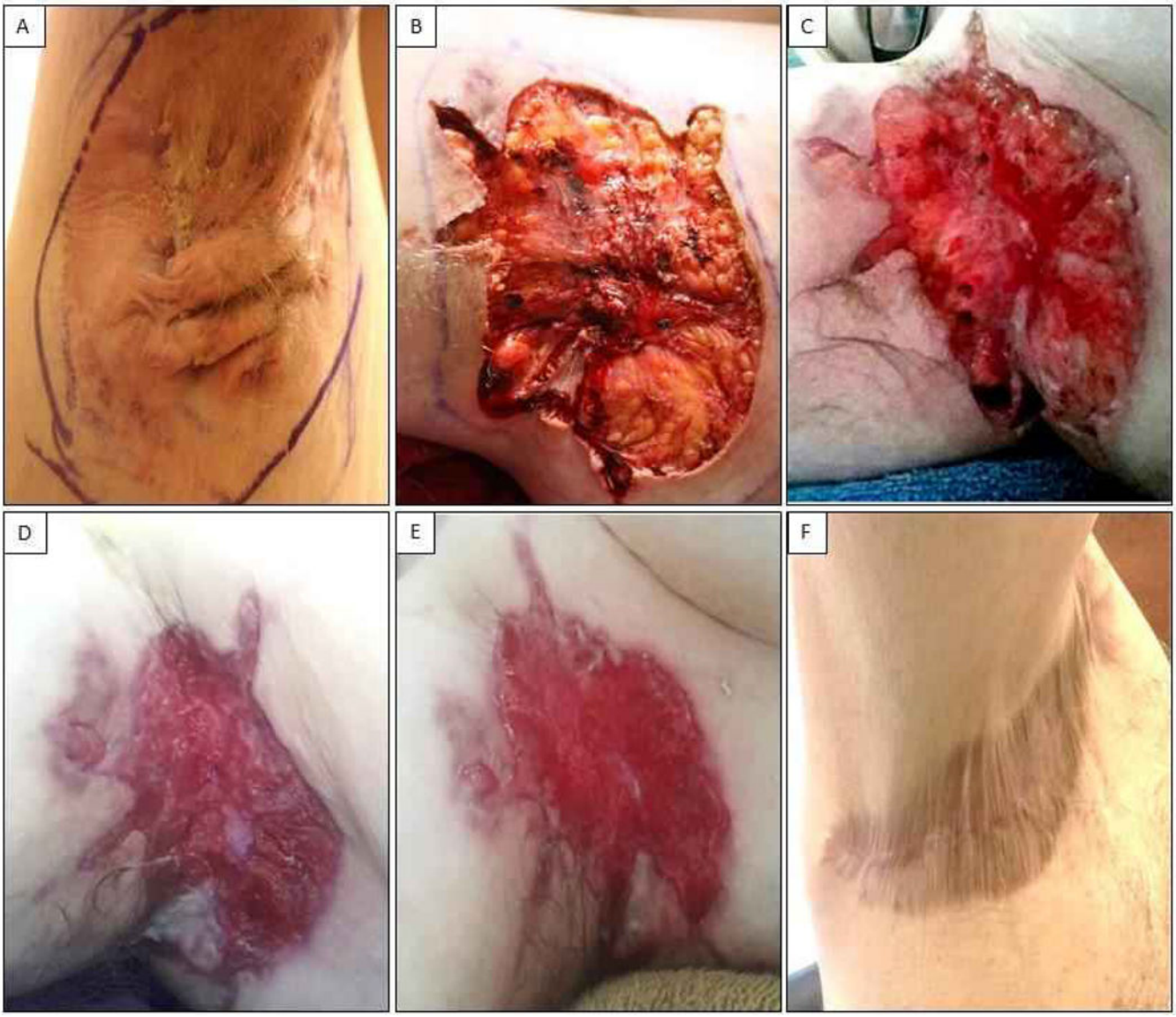

Figure 5:

Wound healing following CO_2 excision of right axilla

(A) Prior to excision, (B) Immediately post-op, (C) Post-operative day 3, (D) Post-operative week 2, (E) Post-operative week 3, (F) Post-operative week 30

Table 1:

Summary of guideline recommendations for medical treatments in HS

Treatment	North American(13),[a]	British(11),[b]	ALLIANCE(10),[c]	EADV/ EDF(9),[d]	Dosing for adult patients	Ref
Topical treatments						
Benzoyl peroxide	C, III	ND	ND	Θ	• Apply daily or BID	(16)
Chlorhexidine 4%	C, Expert	↑	ND	Θ	• Use as body wash once daily	-
Zinc pyrithione 1%	C, III	ND	ND	Θ	• Use as body wash once daily.	(123)
Clindamycin 1%	C, II/III	↑	B, II	↑↑	• Apply BID	(14–16)
Dapsone	C, Expert	ND	ND	Θ	• 5% BID or 7.5% daily	(124)
Resorcinol 15% cream	C, III	ND	ND	↑	• For flares: Apply BID; Maintenance: Apply daily or BID	(21,22)
Sodium fusidate 2%	ND	ND	ND	ND	• TID: Wash with antibacterial soap x 10 minutes, then apply ointment	(125)
Systemic antibiotics						
Dapsone	C, III	↑	C, IV	↑, 3rd line	• 100–200 mg qD	(38,126)
Ertapenem	C, III	Θ	C, IV	ND	• 1g IV qD x 6 weeks	(39,40)
Rifampin + Clindamycin	B, II	↑↑	C, IV	↑↑	• Clindamycin 300 mg BID • Rifampin 600 mg qD, 300 mg BID, or 10 mg/kg qD • Duration: 10 – 12 weeks	(26–30)
Rifampin + Moxifloxacin + Metronidazole	C, II	ND	C, IV	↑	• Metronidazole 500 mg TID x 6 weeks • Moxifloxacin 400 mg qD until 6 wks after remission and ≥ 12 wks • + Rifampin 10 mg/kg qD until 6 wks after remission and ≥ 12 wks	(35,36)
Tetracyclines	C, II/III	↑↑	B, II	↑↑	• Tetracycline 500 mg BID • Doxycycline 50–100 mg BID • Minocycline 100 mg BID + colchicine 0.5 mg BID	(15,112)
Steroids					•	
Triamcinolone (intralesional)	C, III	↑	C, IV	↑	• 10 mg/mL, injected locally for acute nodules and abscesses • 40 mg/mL 0.5 cc injected into sinus tracts • Other concentrations unstudied, but likely effective.	(41,42,127)
Systemic corticosteroids	C, III	Θ	C, IV	↑	• *As adjunct:* Prednisone 10 mg qD tapered to minimum effective dose • *As rescue/bridge:* Prednisone 0.5–1 mg/kg/D for several weeks • *Rescue in hospitalized patient:* methylprednisolone 1g IV qD x 3 days	(44)
Hormonal therapies						

Treatment	North American(13), [a]	British(11), [b]	ALLIANCE(10), [c]	EADV/ EDF(9), [d]	Dosing for adult patients	Ref
Anti-androgen contraceptives	C, II	ϴ	ND	↑	• No studies to direct dosing/selection of currently available options	(45,46)
Finasteride	C, III	ϴ	ND	ND	• Children: 1–5 mg/day; Max dose reported 10 mg/day • Adults 5 mg/day	(47–50)
Metformin	C, III	↑	ND	ND	• 500 mg daily, increased by 500 mg each week to max dose of 500 mg TID	(51,52,56)
Liraglutide	ND	ND	ND	ND	• 0.6 mg SC daily increased by 0.6 mg weekly to max dose 1.8 mg daily	(55,56)
Spironolactone	C, III	ϴ	ND	ND	• 25–150 mg daily; Most common dose: 75–100 mg daily	(53,54)
Systemic retinoids						
Acitretin	B, II	↑	3rd line: C, IV	↑↑	• 0.5–0.6 mg/kg/day for 9–12 months	(65–68)
Isotretinoin	B, II	↓↓	ND	↓↓	• 0.5–1 mg/kg/day for 4–8 months • British guidelines state only use if concomitant moderate/severe acne	(57,59–64)
Biologics						
Adalimumab	A, I	↑↑	1st line: B, II	↑↑	• Adults and adolescents ≥12 years old weighing >60 kg: 160 mg D1, 80 mg D15, then 40 mg weekly starting D29 • Adolescents ≥12 years old weighing 30–60 kg: 80 mg D1, 40 mg D8, and 40 mg every other week starting D22	(69–71,79)
Infliximab	B, II	↑	2nd line: B, II	↑↑	• 5–10 mg/kg at W0, W2, W6 and every 4–8 weeks thereafter • 10 mg/kg q6–8 weeks appears more effective than lower starting doses	(81,82,128)
Apremilast	ND	ϴ	ND[g]	ND	• 10 mg on D1, increased by 10 mg/d until reaching goal dose of 30 mg BID	(86,129)
Anakinra	B, II	ϴ	3rd line: B, II	ND	• 100 mg daily	(88)
Ustekinumab	B, II	ϴ	3rd/4th line: C, IV	ϴ	• 45 mg (if ≤100 kg) or 90 mg (if >100 kg) on W0, W4, and q12 weeks • IV infusion W0 (≤55 kg 260 mg; 56–85 kg 390 mg, >85 kg 520 mg); Then, 90 mg SC q8 weeks starting 8 weeks after induction	(90,91,130)
Golimumab	C, III	ND	ND	ND	• 200 mg on D0 then 100 mg q4 weeks	(98,99)
Secukinumab	ND	ϴ	ND	ND	• 300 mg weekly for 5 weeks, then q4 weeks thereafter	(101–105)
Guselkumab	ND	ND	ND	ND	• 100 mg at W0, 4, q8 weeks thereafter	(106,131)
Etanercept	Not recommended: C, II	↓↓	Not recommended: B, II	↓↓	• Not recommended	(92–97)
Other medications						
Azathioprine	Not recommended, III	ϴ	ND	ND	• Not recommended	(132)

Treatment	North American(13), [a]	British(11), [b]	ALLIANCE(10), [c]	EADV/ EDF(9), [d]	Dosing for adult patients	Ref
Botulinum toxin	ND	ND	ND	Θ	• Experimental	(133,134)
Colchicine	C, III – only with minocycline	Θ	"Further investigation warranted."	↓↓	• Minocycline 100 mg BID + colchicine 0.5 mg BID	(112,113)
Cyclosporine	C, III	Θ	ND	↑: As 4th line tx	• 2.0–3.5 mg/kg/day	(114,135)
Methotrexate	Not recommended, III	Θ	ND	ND	• Not recommended as monotherapy	(136)
Zinc gluconate	ND	Θ	C, IV: With triclosan	↑	• 90 mg daily +/− topical triclosan 2% BID	(108,109)

[a] Recommendation level and evidence grade according to Strength of recommendation taxonomy (SORT)(137)

[b] Recommendations according to British Association of Dermatologists adoption of GRADE methodology;(138)

[c] Levels of Evidence and Grades of Recommendation according to Oxford Centre for Evidence-based Medicine;(139)

[d] Recommendation category defined by the authors review of narrative text and confirmed with the senior author of the EADV/EDF guidelines (GBEJ);

BID: twice daily; EADV/EDF: European Academy of Dermatology and Venereology/European Dermatology Forum; ND: Not discussed; tx: treatment; D1: Day 1; D15: Day 15, etc; W0: Week 0; W2: Week 2; etc.

↑↑: Strong recommendation for the use of an intervention or inclusion in primary treatment algorithm;

↑: Weak recommendation for the use of an intervention;

Θ No recommendation-Insufficient evidence to support any recommendation;

↓↓: Strong recommendation against the intervention

Table 2:

Guidelines for lifestyle modifications in HS

Lifestyle modifications	North American(13), [a]	British(11), [b]	ALLIANCE(10), [c]	EADV/EDF(9), [d]
Smoking cessation	C, III	↑	A, I	↑
Weight loss	C, II	↑	C, IV	↑
Dairy avoidance	[C, III][e]	Θ	ND	ND
Brewer's yeast avoidance	[C, II][e]	Θ	ND	ND
Mechanical irritation/ tight clothing avoidance	[C, III][e]	↑	ND	Θ
Shaving/depilation avoidance	[C,II][e]	ND	ND	ND

[a] Recommendation level and evidence grade according to Strength of recommendation taxonomy (SORT)(137);

[b] Recommendations according to British Association of Dermatologists adoption of GRADE methodology(138);

[c] Levels of Evidence and Grades of Recommendation according to Oxford Centre for Evidence-based Medicine(139);

[d] Recommendation category defined by the authors review of narrative text and confirmed with the senior author of the EADV/EDF guidelines (GBEJ);

[e] Text from North American Guidelines states that "Insufficient evidence exists to recommend avoidance of dairy or brewer's yeast, vitamin D supplementation, avoidance of friction, deodorant, and depilation/shaving.

EADV/EDF: European Academy of Dermatology and Venereology/European Dermatology Forum; ND: Not discussed;

↑↑: Strong recommendation for the use of an intervention or inclusion in primary treatment algorithm;

↑: Weak recommendation for the use of an intervention;

Θ No recommendation-Insufficient evidence to support any recommendation;

↓↓: Strong recommendation against the intervention.

Table 3:

Summary of guideline recommendations for procedural management of HS

Treatment	North American(13), [a]	British(11), [b]	ALLIANCE(10), [c]	EADV/EDF(9), [d]	Dosing for adult patients	Ref
Laser/Light therapy						
Alexandrite (755 nm)	C, III	Θ	ND	ND	• Hurley stage I/II • Fitzpatrick skin type I-III	(140–142)
Fractional ablative CO_2 (10,600 nm), for scars	C, III	Θ	ND	ND	• Treats chronic ulceration and improves range of motion after HS excision • Fitzpatrick skin type I-VI	(143,144)
Diode (1450 nm)	C, III	Θ	ND	ND	• Hurley stage I/II • Fitzpatrick skin type I-III	(145)
Intense Pulsed Light	C, III	Θ	ND	Θ	• Hurley stage I/II • Fitzpatrick skin type I-III	(23,146,147)
Nd:YAG (1064 nm)	B, II	Θ	ND	↑↑	• Hurley stage I/II • Fitzpatrick skin type I-VI	(16,115,116)
Nd:YAG(1064 nm) + Fractional CO_2	ND	ND	ND	ND	• Hurley stage I/II	(148)
Photodynamic therapy	C, II/III	Θ	ND	Θ	• Wide variety in reported techniques and effectiveness	(149,150,159–161,151–158)
Radiation, external beam	C, III	Θ	ND	ND	--	(162–165)
Radiofrequency	C, III	Θ	ND	ND	--	(166)
Fistula-tract Laser Closure	ND	ND	ND	ND	• Report of use in two cases of complex urethroperineal fistula closures	(167)
Microwave ablation	ND	↓↓	ND	ND	• Not recommended	(168,169)
Surgical procedures						
Incision and drainage	C, II	ND	C, IV	ND	• May relieve pain from acute abscess, but lesion almost always recurs	(170,171)
Deroofing	B, II	ND	C, IV	↑↑	• Relieves pain in acute abscess • Opening of sinus tracts in dermis	(170,172–175)
Skin-sparing excision with electrosurgical peeling (STEEP)	C, II	ND	C, IV	↑	• Removal of sinus tracts in dermis/fat	(119,176,177)
Electrosurgery	C, III	Θ	ND	ND	• Removal of sinus tracts in dermis/fat	(178)
Surgical excision	B, II	↑	C, IV	↑↑	• Removal of sinus tracts in dermis/fat	(170,171,187–192,179–186)
CO_2 Laser excision (10,600 nm)	C, II	Θ	C, IV	↑↑	• Removal of sinus tracts in dermis/fat	(193–197)

Cryoinsufflation	C, III	↓↓	ND	ND	• Insufficient evidence to recommend	(198–201)
Closure technique after excision						
Secondary intention	C, II	↑	ND	↑	• Patient/surgeon preference	(202–206)
Primary closure	C, II	ND	ND	↑	• Patient/surgeon preference	(207,208)
Flap	C, II	ND	ND	↑	• Safest choice when arteries/major motor nerves exposed.	(209–215)
Skin graft	C, II	↑	ND	↑	• Patient/surgeon preference	(215–219)
Skin substitutes	C, II	ND	ND	ND	• Patient/surgeon preference	(220,221)
Combination Therapy						
Continue biologics pre- and post-operatively.	ND	ND	C, IV	ND	• Recommended for all patients on biologics prior to surgery	(222)

[a] Recommendation level and evidence grade according to Strength of recommendation taxonomy (SORT)(137);

[b] Recommendations according to British Association of Dermatologists adoption of GRADE methodology(138);

[c] Levels of Evidence and Grades of Recommendation according to Oxford Centre for Evidence-based Medicine(139);

[d] Recommendation category defined by the authors review of narrative text and confirmed with the senior author of the EADV/EDF guidelines (GBEJ);

EADV/EDF: European Academy of Dermatology and Venereology/European Dermatology Forum; ND: Not discussed;

↑↑: Strong recommendation for the use of an intervention or inclusion in primary treatment algorithm;

↑: Weak recommendation for the use of an intervention;

Θ No recommendation-Insufficient evidence to support any recommendation;

↓↓: Strong recommendation against the intervention.