Hidradenitis Suppurativa

Gregor B. E. Jemec

Journal of Cutaneous Medicine and Surgery
Incorporating Medical and Surgical Dermatology
DOI: 10.1007/s10227-002-2104-z
J Cutan Med Surg 2003; 47–56

Abstract

Background: Hidradenitis suppurativa is a clinically defined disease that causes considerable morbidity for patients. The results of recent studies, which have increased the understanding of this disease, are reviewed.

Objective: The epidemiology, risk factors, pathogenesis, and treatment of this disease are summarized to help clinicians with practical patient management.

Conclusion: Hidradenitis suppurativa remains a clinical challenge to patients and physicians alike. Physicians should be familiar with the impact this disease has on the patient and with the range of treatments available. Use of simple incisions as treatment is strongly discouraged. Additional pathogenic as well as therapeutic studies are necessary.

Sommaire

Antécédents: L'hidrosadenite suppurante est une entite clinique bien definie qui est une cause importante de morbidite. Les resultats d'etudes recentes qui ont accru la comprehension de cette maladie sont revus dans cette etude.

Objectifs: L'epidemiologie, les facteurs de risque, la pathogenicite, et le traitement de cette maladie sont resumes dans le but d'aider la gestion pratique de ces patients.

Conclusion: L'hidrosadenite suppurante reste un defi clinique a la fois pour les patients et pour les medecins. Les praticiens devraient de plus se familiariser avec l'impacte de cette maladie sure le patient et avec les traitements disponibles. Les lecteurs sont dissuades d'utiliser de simples incisions comme traitement. Des etudes pathogeniques et therapeutiques supplementaires sont necessaires.

Hidradenitis suppurativa (HS) is a clinical entity based on a clinical definition. The diagnostic criteria are wide and usually include scarring, the recurrent nature of the disease, and the characteristic multifocal location restricted to axillae, inframammary region, and groin.[1] Inflamed pilonidal cysts and staphylococcosis are the most common differential diagnoses, but rarer differential diagnoses such as multiple trichoepitheliomas, steacystoma multiplex, and apocrine nevus exist.[2–4] A staging classification of hidradenitis has been proposed by Hurley.[5] The Hurley classification describes the evolution of the disease from early localized inflammation to fulminant disease (Fig. 1).

No pathognomonic signs exist, but clues to the diagnosis are provided by the distribution of the lesions and their clinical appearance. Early studies stressed the shape of the lesions, describing them as characteristically rounded rather than pointed as seen in furunculosis, the lack of central necrosis, and the "deep" location.[6,7]

Definition

Hidradenitis suppurativa is a recurrent disease, restricted to inverse areas, and characterized by a progression from noninflamed nodules to painful, rounded, deep-seated, inflamed lesions and subsequent scarring and chronic suppuration (Fig. 1). Nodules are restricted to the skin and may persist for years with occasional episodes of inflammation. Inflamed nodules progress into scarred lesions when spontaneously draining dermal sinus tracts appear. Sinus tracts persist and cause periodic flares of inflammation. The end stage is characterized by widespread scarring in the region.

Nosology

Classification of diseases or nosology is important for our understanding of the pathological processes and subsequent clinical management of disease. HS was first described by Velpeau in 1839 (quoted in ref. 8) based on the characteristic distribution of the lesions, i.e., the

Division of Dermatology, Department of Medicine, Roskilde Hospital, Roskilde, Denmark

Online publication: 4 December 2002

Correspondence to: Gregor B. E. Jemec, Division of Dermatology, Department of Medicine, Roskilde Hospital, DK-4000 Roskilde, Denmark, E-mail: ccc2845@vip.cybercity.dk

FIGURE 1 Typical hideadrentitis suppurative. Recurrent abscesses with tract formation and cicatrization. Single or multiple, widely separated lesions.

"anatomical predisposition" of the affected regions. Later, Verneuil[8] described the clinical course and suggested an association with the sweat glands which were particularly "well developed" and "voluminous" in the affected areas. He identified HS as a subcutaneous process and distinguished it from furunculosis.

This idea was perpetuated until Pillsbury coined the term "follicular occlusion," suggesting that acne vulgaris, perifolliculitis capitis, pilonidal cysts, and hidradenitis are closely related diseases involving the hair follicle.[9–12] Clinical manifestations and response to treatment, however, remain very different, e.g., acne prominently involves the sebaceous apparatus while HS does not.[13,14] The continued publication of case reports of the follicular occlusion triad also suggest that co-occurrence is rare.[15–17] Even if the diseases are not identical, they may share pathogenic steps involving the hair follicle. Human experiments by Shelly and Cahn[18] reproduced HS-like lesions in healthy volunteers after occlusion of the hair follicles, and the concept is further supported by recent histological studies.[19–21] Some authors are now proposing that the term hidradenitis be abolished in favor of a new term "acne inversa."[22–25] The distinction between the new acne inversa and the old follicular occlusion triad is unclear, and thus both theoretical and practical problems remain associated with this new concept.

Epidemiology

Studies have estimated the prevalence at 1/3000 without specifying a time frame or specific diagnostic criteria.[26] In a study of the "hidden" or unrecognized" dermatological diseases in patients attending a dermatological clinic, a physical examination of general dermatological patients found a point prevalence of hidradenitis at a rate of 1/1000.[27] From interviews among healthy women (mean age 31 years), a lifetime prevalence rate of 4% was found.[28] The women interviewed were all hospital employees (nurses and students) and therefore may have overreported events in comparison to the general population.

Later studies of a population sample in Denmark, using the proposed combined clinical definition of positive signs and symptoms and exclusion criteria, found that hidradenitis was more common than previously estimated, with a point prevalence of 4.1% (3.0–6.0%) in a younger adult population.[29,30] A one-year prevalence of 1% (0.4–2.2%) in the general population was based on the subjects' recollection only and is similar to that of other major dermatoses, e.g., psoriasis.[29–31]

Active hidradenitis is generally more prevalent in women with an odds ratio of 2.9.[29,30] Active genitofemoral lesions occur significantly more often in female patients, while no *sex* difference is seen in the rarer axillary lesions. Noninflamed quiescent nodules are also more prevalent in women and in genitofemoral lesions. Comedomes have been suggested as precursor lesions for HS, but, in contrast to the manifested disease, they appear to be equally distributed in both sexes and sites.

Etiology and Pathogenic Factors

A limited number of investigations into the etiology of hidradenitis have been made. Hidradenitis has been described in dogs, but no experimental studies are available using a canine model of the disease.[32]

Genetic Factors

HS patients report cases among their relatives more frequently than controls, and families in which hidradenitis, acne, and other poral occlusion diseases occur have been reported.[15,28,33,34] However, specific genetic studies have yielded conflicting results. One study has suggested that inherited factors may be important in hidradenitis following HLA-typing in 27 patients, although the results did not reach statistical significance due to the small number of patients used.[35] A later and larger study of HLA in Swedish patients compared with a population sample did not find any HLA-A, HLA-B, HLA-DR association.[36] One study describing an autosomal dominant pattern of inheritance has also been reported, but the penetrance appeared variable, indicating that other non-

genetic factors are involved.[36,37] A later review of the data has renewed the suspicion of a dominant pattern of inheritance in this group of patients using a better clinical definition of the cases.[38]

Co-occurrence of phenotypes may support a genetic linking. In case reports or series of case reports, hidradenitis has been associated with a number of diseases. Most frequently, association with Crohn's disease (n = 34) and Dowling--Dego's disease (n = 8) has been reported.[39–46] However, it is unclear to what extent these reports truly reflect hidradenitis lesions as defined in the above, and even if these observations represent causal relationships or merely the coincidental findings of a comparatively common disease such as hidradenitis.

Immunological Host Factors

An immunological etiology of HS has been considered a possible predisposing factor to bacterial infection. One study failed to identify immune deficiency in HS patients, although individual patients may be found in whom correctable bactericidal effects can be identified.[47,48] It should be noted that disease definition in this case was poor. Immunology may also play a role independent of bacteria. A pilot study suggested that excessive free oxygen radical generation by neutrophils from HS patients may be an etiologic factor, although the data are preliminary and require additional verification.[49] Similar mechanisms have previously been implied in paradentosis and inflammatory bowel disease which share histological features with HS.

Hormonal Factors

Hyperandrogenic syndromes are clinically expressed in women.[50–55] A clear female preponderance exists in HS. It appears to occur exclusively in adults, but it may occur as the presenting feature of adrenarche (n = 5) or with acne in acromegaly (n = 1).[56–58]

Premenstrual flareup is reported in several studies by approximately 50% of women with hidradenitis, while improvement is reported by only a minority.[54,59,60] Flareups may be absent in anovulatory cycles.[53] Pregnancy and childbirth are also reported to influence the intensity of the disease favorably, with subsequent postpartum flareup.[28,50] Reduced fecundity in some patients may be causally related to the changes in circulating sex hormones, but correlation with clinical markers of hyperandrogenism is poor.[28]

Careful studies of cutaneous signs of virilism, including sebum excretion rate, have failed to show any significant abnormalities in hidradenitis patients, further supporting a localized androgen effect.[61] However, it should be noted that the variation in hirsutism and acne scores in hidradenitis patients was larger than in healthy controls, which may suggest that a subpopuiation of patients exists in whom signs of cutaneous virilism are more pronounced and where androgens may play a pathogenic role.[61] Antiandrogenic treatment has been found to be effective in some cases and in one randomized controlled trial.[62–65] The mechanism behind this effect is not clear. In a published measurement of circulating androgens, a considerable overlap to normal values was found, suggesting that end-organ sensitivity may be involved, and it has been suggested that infrainfundibular keratinocytes have an increased capacity for androgen metabolism which may play a role in follicular hyperkeratinization.[66] There have also been studies that failed to show any abnormalities of circulating androgens in hidradenitis.[60,67]

The main weaknesses of the articles dealing with possible androgen involvement are the possible confusion of acne conglobata with HS and the wide range in the level of circulating androgen which shows a large number of patients with normal or low androgen levels. A number of patients diagnosed in these studies also had extensive acne lesions, leading to the speculation that what was interpreted as hidradenitis was in fact acne, an acknowledged androgen-sensitive disorder. Finally, the possible pathogenic role of androgens is further confounded by early reports suggesting that testosterone can be used in the treatment of hidradenitis.[9] The exact role of androgens in HS therefore remains to be established.

The use of oral contraceptives may also affect potential androgen-dependent diseases.[68] The pattern of use among patients was not different from that of the general population. Finally, the female preponderance may also be explained by other sex-specific factors such as the oestrogenic influence on inflammation.[69]

Obesity

Obesity has often been suggested as an etiological factor.[52,70–73] Previous studies have shown conflicting results: one study found HS patients to be more obese (n = 11),[71] another study was unable to reproduce the findings (n = 76).[74,75] It is suggested that while obesity may not be a primary pathogenic factor, it may aggravate preexisting hidradenitis through mechanical irritation, occlusion, and maceration.

Infection

Bacteria have traditionally been implicated in hidradenitis. Early histological studies suggested staphylococci to be causally involved, and, although later studies have separated staphylococcosis and hidradenitis as two different clinical entities, topical and systemic antibiotics are still used in the treatment of hidradenitis.[1,76]

Routine microbiological culture of lesions is frequently negative, although more extensive investigations have managed to identify a number of different bacteria in lesions diagnosed as hidradenitis: staphylococci, *S. lugduniensis*, *Strep. milleri*, *Bilophila wadsworthia*, and anaerobes.[35,77–82] The species have been isolated from a wide range of lesions at many different stages and definitions of hidradenitis. Frequently, the different species of bacteria have also been found in only a few cases as a

part of more general investigations of the flora of skin infections.[78–80]

Sampling problems may have influenced the results of these studies. Needle aspiration of early lesions has yielded recognized pathogens in a minority of the examined lesions (9/41; *S. aureus* in 8/41 lesions and *S. milleri* in 1/41).[83] Patients seek medical help sooner if their lesions contain *S. aureus* than if their lesions contain other bacteria or are sterile. A more recent study has attempted to overcome the sampling problems by using laser ablation to expose the HS lesions before sampling.[84] Using this technique, the involved structures can be visualized before sampling and thus the sampling error is abolished. In the study,[84] positive cultures were found in all the examined patients, with *Staph. aureus* and coagulase-negative staphylococci found most frequently.[84] Therefore, it is speculated that coagulase-negative staphylococci play a pathogenic role. These bacteria are known to produce clinically significant infections in association with nonvital tissue and artificial implants or allografts.[85,86] In HS an analogous situation may exist in conjunction with the spillover of follicular material from ruptured hair follicles. IgG precipitins have been studied as an indirect measure of bacterial involvement in HS.[83] No association between precipitins and bacteria was found, nor did the precipitins clearly differ from normal values. The highest number of precipitins was found against *S. aureus*.

Infections may co-occur with HS. A possible causal association between genitofemoral hidradenitis and *Chlamydia trachomatis* has been suggested, but the organism was not found in the pus of any lesion.[87] A study of patients attending an STD clinic failed to identify any association between *Chlamydia* infection and HS but suggested that human papilloma virus (HPV) infection was more common in HS patients.[10] It has also been suggested that HPV infection is a cofactor in complications such as malignant degeneration of HS lesions.[88] The possible causal relationship of HPV infection and the primary hidradenitis lesion is obscure, although the virus has been associated with palmar cysts through infection of the distal eccrine duct.[89]

Drugs

Hidradenitis is rarely a side effect of drug use, but oral contraceptives ($n = 7$) and lithium ($n = 1$) have been associated with its development.[68,90,91]

Cosmetics

Early reference suggested a causative role for cosmetics, especially in women shaving their axillae on the assumption that shaving may provide an entry point for bacterial infection.[6,92] Self-reported skin irritation due to cosmetics is significantly more common in HS patients.[28] Two studies have been unable to identify differences in the pattern of use of cosmetics, shaving, or use of talcum in HS.[28,92] Histological data which could substantiate an irritant component of early HS provide mixed results. One study found infrainfundibular spongiosis in early lesions, while another study found no signs of irritant reactions (spongiosis or parakeratosis).[21,93] The study by Shelley and Cahn[18] has been interpreted to imply a role for cosmetics in HS. They epilated the axillae of 12 healthy volunteers and applied occlusive tape for one week to produce "hidradenitis-like" lesions, which is obviously different from customary use of cosmetics.

Tobacco

Two independent epidemiological studies have suggested that the use of tobacco by HS patients is more common than among healthy controls, although no specific mechanism has been identified to link the use of tobacco with HS.[94,95]

Lung and buccal cancers are more common among HS patients than in the general population as would be expected with increased tobacco smoking or chewing.[96]

Morphology of Hidradenitis Suppurativa

Histology

Hidradenitis is a follicular disease that may secondarily involve other structures such as apocrine or eccrine glands (Fig. 2).[21] Occlusion of the hair follicle produces hidradenitis-like lesions,[18] while destruction of the apocrine gland duct orifices produces distended apocrine glands.[97] Pure apocrine gland affection is found in 5% of the cases, predominantly occurring in the axilla, and is clinically indistinguishable from HS.[21] The follicular nature of the disease seen is highlighted by the description of spongiform inflammatory changes of the infrainfundibullum of early lesions.[93] The HS lesions present a consistent histological image as shown in a study of multiple biopsies from individual patients.[98]

Sinus tracts have been heralded as the hallmark of hidradenitis and used to further underline the similarities between hidradenitis and acne.[24,99] It is not clear whether sinus tract formation is a host-specific response pattern of or a specific trait connected to the diagnosis of hidradenitis. Sinus tracts have been experimentally produced in the rhino-mouse by inserting a transdermal suture from one distended follicle to another, suggesting that it is related to the host rather than to the stimulus.[100]

Based on published histological studies, it is suggested that HS is an inflammatory disease originating from the hair follicle and subsequently spreading inflammation to the surrounding tissues where characteristic secondary changes develop.[21,101] Sinus tract formation is speculated to represent reparative mechanisms that encapsulate necrotic debris, and, with abnormal hair follicles, sinus tracts may create the morphological prerequisites for the subsequent chronic, recurrent course of the disease.

FIGURE 2 Histology of hidradenitis suppurativa. Lesions show inflammatory infiltrate surrounding hair follicles (*top*), while apocrine glands are unaffected (*bottom*).

High-Frequency Ultrasound

Normal hair follicles appear as elongated, parallel, low echogenic structures occurring at regular intervals within the dermis and oriented at an angle of approximately 45°–60° to the surface of the skin as seen in normal histology specimens. In HS, changes have been found in the clinically uninvolved axillary and genitofemoral hair follicles. The follicles appear to be of a larger diameter and a distorted shape with a wider deep follicular diameter, in agreement with the clinical impression that the primary event in HS is deep-seated rather than superficial.[102]

Consequences and Complications

HS causes significant morbidity. The general self-reported level of health is poorer among HS patients; the average Danish patient lost 2.7 days of work per year (stages I and II) due to flareups of HS.[74] Similarly, the quality of life is lower than in any other dermatological disease studied using the DLQI for assessment of life quality.[103] The data strongly support the clinical impression that HS is a "heart sink" condition for patients.

The soreness, discharge, and appearance of lesions are described as problems in both work and leisure activities by 51% of all patients. For grades I and II, the main problem is soreness, which can be used to assess the efficacy of treatment.[74,104]

A number of case reports exist describing rare but serious complications. Death due to HS has occurred ($n = 2$).[105,106] Nonlethal complications range from anemia to increased white blood cells.[107] HS-associated arthritis, axial spondyloarthropathy, and sterile osteomyelitis-like lesions also occur but do not appear to be associated with HLA B27.[108–110]

Rare complications include benign and malignant ulcers arising from chronic hidradenitis ($n = 37$).[88,111] Squamous cell carcinomas originating from HS lesions may be associated with hypercalcemia.[112] A general association between HS and cancer was confirmed in a nationwide case-control study involving all Swedish HS patients admitted to hospital between 1987 and 94.[96] It was shown that HS patients have a higher overall incidence of cancer (1.5; 1.1–1.8) than the general population. The incidence of nonmelanoma skin cancer standard incidence rate (SIR) = 4.6; 1.5–10.7), buccal (SIR = 5.5; 1.8–12.9), and hepatic cancer (SIR = 10.0; 2.1–29.1) was increased.

Finally, there are complications caused by the chronic inflammation of hidradenitis extending to surrounding tissues, e.g., edema of the scrotum or breast, fistulas, anorectal abscesses, and polypoid outgrowths.[67,113–115]

Treatment

Physical or Adjuvant Treatment

Early studies stressed the usefulness of wet warm compresses, unspecified ointments, and sulfur. As an indication of the clinical difficulties of treating hidradenitis, it may be noted that some of these treatments are still used today.[1] The avoidance of mechanical stress on the surface of the skin, i.e., shear forces, is also commonly recommended, although no experimental evidence exists to support the advice. It has been speculated that the abnormally thick skin and dystrophic hair follicles are more susceptible to mechanical stresses, but no experiment has yet been designed to test this hypothesis.

Radiotherapy

A body of early literature supports the use of X rays in depilatory doses and a total dose of 1.5–18 Gy. A dosage giving temporary epilation has been suggested as optimal by Zeligman.[116] The dosage given in a single-session treatment schedule was 4–5 Gy (100 kV, 100 mA, 0.8-mm Al filter), reportedly with good effect and without subsequent irradiation dermatitis or scarring. This suggests that improved drainage of the follicle may be of importance to the clinical effect, although the locally immunosuppressive effect may also play a role.[117–119] No randomised controlled trials (RCTs) have been con-

ducted in this field. The possible beneficial effects of laser epilation do, however, suggest that hair removal may be of independent importance (personal observation, G.B.E. Jemec).

Antibiotics

It has been pointed out that the standard length of antibiotic treatment closely resembles the duration of untreated flares in HS.[38] However, antibiotics continue to be widely used in the treatment of hidradenitis. They are used both as monotherapy and in conjunction with surgery. While they are of crucial importance in the treatment of concomitant bacterial infection, antibiotics role *vis-à-vis* HS is currently as unclear as the role of bacteria in the disease.[95]

Topical clindamycin has been shown to have an effect in a double-blinded placebo-controlled study ($n = 30$). A significant reduction of symptoms was seen within one month of treatment ($p < 0.01$). A subsequent 3-month double-blinded double-dummy study comparing topical clindamycin with systemic tetracyclin ($n = 34$) failed to show significant differences between the two treatments.[104,120]

Hormonal Therapy

The possible beneficial effects of testosterone is a curious contrast to the results of a double-blinded crossover trial which found cyproterone acetate useful.[9,63,64,121] Cyproterone actetate in combination with enthinylestradiol is the only other treatment, apart from topical clindamycin, that has been shown to have an effect in a controlled trial. A dose of 50 µg ethinyloestradiol/50 mg cyproterone acetate was compared with 50 µg ethinyloestradiol/500 µg norgestrel and found to be superior, with 29% of the patients (7/24) clearing completely and 21% (5/24) improving within an 18-month followup period.[63]

Finasteride may have also an effect[65] as may more aggressive manipulation of the sex hormones, e.g., the use of gonadotropin-releasing agonists in combination with oophorecto-salpingecto-hysterectomy.[122,123] Combination therapy with antiandrogens and antibiotics has also reportedly been successful.[124]

Immunosuppressive Treatment

Since the disease is not a classic infectious disease universally caused by known pathogens, simple antiinflammatory treatment offers great relief for many patients. ACTH, hydrocortisone, azathioprine, and cyclosporin have all been used with good effect.[45,90,125,126] Prednisolone may be used as adjuvant treatment, for periodic systemic therapy to treat flareups (personal communication, Dr. J. von der Werth) or intralesionally.[127] More specific, targeted therapy using infleximab has been reported in a case, and it may hold more promise for future therapy.[128] Appropriate bacteriological sampling must be obtained if antiinflammatory therapy is instituted.

Recently, the successful outcome of dapsone treatment has been reported.[129]

Retinoids

Retinoids have been tested in a number of case reports. No double-blinded design studies have been published. The predominant number of publications deal with the use of isotretinoin in a dosage similar to acne treatment, but reports have also been published on the use of etretinate and acitretin.[23,45,121,130–140] Etretinate and acitretin may have an effect in patients who are unresponsive to isotretinoin.[132]

The biggest case series ($n = 68$) suggests that less than 25% of HS patients derive benefit from isotretinoin therapy, although it has been suggested that a longer treatment period may be necessary than in acne.[130,141] One review has suggested that patients in which hidradenitis occurred in conjunction with acne lesions on convex areas of the body, i.e., acne conglobata with lesions in inverse regions, were more responsive than patients in whom lesions were confined to the inverse regions.[131]

Surgery

Removal of the lesions through surgery is strongly recommended at an early stage of the disease. The published data on the efficacy of different methods are neither uniform nor extensive; a more uniform reporting would therefore improve the usefulness of future reports.

Simple lancing is ineffectual and should actively be discouraged.[5,142,143] An improved technique involves exteriorization of the lesion.[5] Proper exteriorization involves removal of the "roofs" of sinus tracts, removal of all granulation tissue by curettage, and healing by secondary intention. A similar result can be achieved by CO_2 laser evaporation of the tissue. This method allows visualization of the lesions during the procedure and therefore may be less invasive than cold steel surgery. Good results have been reported with low recurrence rates and healing times of 3–5 weeks.[144,145]

Specific factors appear to influence the risk of recurrence:

The Extent of the Excision

Single-lesion treatment offers lower immediate morbidity, while larger excisions may offer a better prognosis. Long-term followup of simple excision has shown a wide range of recurrence rates (see Table I). This reflects two aspects of surgical treatment: First, when single or adjacent elements are excised, recurrences do occur locally even after surgery; second, patients may develop new foci of hidradenitis in another region. Local recurrences may appear either rapidly and in direct association with the scar, suggesting that diseased tissue had been left at the time of operation, or over a longer period suggesting *de novo* occurrence of disease. The appearance of new foci strongly suggest the disease is intrinsically multifocal.

TABLE I

Reported results of surgery*				
Method of closure	*Region*	*Followup Months* (range)	*Recurrence rates*	*Year* (ref.)
Primary closure	Mixed	38 (? – ?)	21% (5/24)	1968 (151)
SSG	Mixed	38 (? – ?)	4% (2/53)	—
Flap	Mixed	38 (? – ?)	22% (2/9)	—
Primary closure	Mixed	~120	42% (18/43)	1981 (152)
SSG or Flap	Mixed	~120	0% (0/42)	—
Incision	Mixed	n.a.	83% (10/12)	1982 (153)
Primary closure	Mixed	n.a.	30% (3/10)	—
SSG	Mixed	n.a.	13% (3/24)	—
Secondary healing or SSG	Mixed	47 (6–89)	24% (19/82)	1987 (150)
Primary closure	Mixed	54 (12–132)	78%	1988 (149)
Secondary healing	Mixed	27 (15–47)	25% (6/24)	1994 (144)
Incision	Mixed	72 (? – ?)	100% (6/6)	1998 (143)
Primary closure	Mixed	72 (? – ?)	53% (8/14)	—
SSG or Secondary healing	Mixed	72 (? – ?)	27% (3/11)	—
Mixed	Mixed	36 (6 – ?)	2.5%	2000 (95)
Local excision (primary, flaps, or SSG)	Axillae	n.a.	27% (7/26)	2000 (154)
Hair-bearing skin (primary, flaps, or SSG)	Axillae	n.a.	7% (3/29)	—
Hair-bearing skin + 2 cm (flaps or SSG)	Axillae	n.a.	0% (0/29)	—
Lesion + 2 cm to the fascia	Axillae/groin	96 (0–252)	12%?20%	2001 (155)

* SSG = split-skin graft, n.a. = not available.

The Method of Closure

It has been argued that better results can be obtained by leaving wounds to secondary healing rather than direct closure by apposition, flaps, or grafts. In studies of secondary healing, scarring has not been reported.[146–148] For large lesions this method is slow, and, even though modern bandaging provides good clinical results and improved ease of management, morbidity can still be considerable for a protracted period. Healing periods of several months can be expected following large excisions.

Location

In addition to the extent of excision, the location may be of importance to the outcome of surgery, with perianal and axillary surgery having a lower recurrence rate than inguinoperineal or submammary excision.[149,150] It remains to be seen if the regional differences are merely a secondary factor to the size of the primary excision.

Patient Age

This may also play a role, with older patients having lower recurrence rates irrespective of the preoperative duration.[149,150]

For chronic recurrent diseases, patient satisfaction with any given therapeutic modality is particularly important. No data are available on patient satisfaction with medical treatment, but it is generally found to be high following any kind of surgical treatment. Early and aggressive treatment is therefore recommended as are additional RCTs in this disheartening disease.

References

1. Highet AS, Hay RJ, Roberts SOB. Bacterial infections In: Champion RH, Burton JL, Ebling FJG, eds. Textbook of dermatology. 5th ed. Oxford: Blackwell Scientific Publications, 1990, pp 953–1031.
2. D'Souza M, Garg BR, Ratnakar C, et al. Multiple trichoepitheliomas with rare features. J Dermatol 1994; 21:582–585.
3. Gollhausen R, Besenhard HM, Ruzicka T. [Steatocystoma multiplex conglobatum]. Hautarzt 1988; 39:177–179.
4. Neill JS, Park HK. Apocrine nevus: light microscopic, immunohistochemical and ultrastructural studies of a case. J Cutan Pathol 1983; 20:79–83.
5. Hurley HJ. Axillary hyperhidrosis, apocrine bromhidrosis, hidradenitis suppurative, and familial benign pemfigus: Surgical approach. In: Roenigk RK, Roenigk HHJ, eds. Dermatologic surgery. Principles and practice. New York: Marcel Dekker, 1989, pp 717–743.
6. Tachau P, et al. Schweissdrüsenpyodermien In: Biberstein H, Fuchs D, Jadassohn J, eds. Handbuch der Haut- und Geschlechtskrankheiten. Berlin: Julius Springer, 1934, pp 375–392.
7. Mortimer PS, Lunniss PJ. Hidradenitis suppurativa. JR Soc Med 2000; 93:420–422.
8. Verneuil De. l'Hidrosadénite phlegmoneuse et des abcés sudoripares. Arch gén méd 1864; 2:537–557.
9. Combleet T. Testosterone for apocrine diseases: hidrosadenitis, Fox–Fordyce disease. Arch Dermatol Syph 1952; 65:549–552.
10. Brunsting HA. Hidradenitis suppurativa: abscess of the apocrine sweat gland. Arch Dermatol Syph 1939; 39:108–120.
11. Ebling FJG. Apocrine glands in health and disorder. Int J Dermatol 1989; 28:508–511.
12. Pillsbury DM, Shelly WB, Kligman AM. Bacterial infections of the skin. In: Pillsbury DM ed. Dermatology, 1st ed. Philadelphia: W.B. Saunders, 1956, pp 482–484, 489.
13. Stedman TL. Stedman's medical dictionary, 25th ed. Baltimore: Williams and Wilkins, 1990.
14. Ackerman B, et al. Acne conglobata/acne keloidalis/dissecting cellulitis of the scalp/hidradenitis suppurativa. In: Ackerman B, Chongchitnant S, Sanches J, eds. Histologic diagnosis of inflammatory skin diseases, 2nd ed. Baltimore: Williams and Wilkins, 1997, pp 174–176.
15. Zisova L, Sakalushev B. Acne tetrad in a family. Folia Med Plovdiv 1994; 36:51–57.
16. Mittal RR, Gill SS, Jot T. Follicular occlusion triad. Indian J Dermatol Venereol Leprol 1993; 59:88–89.
17. Boyd AS, Zemtsov A. A case of pyoderma vegetans and the follicular occlusion triad. J Dermatol 1992; 19:61–63.
18. Shelley WB, Cahn MM. The pathogenesis of hidradenitis suppurativa in man. Arch Dermatol 1955; 72:562–565.
19. Layton AM, Pace D, Cunliffe WJ, et al. A prospective histological study of acute hidradenitis suppurativa [abstract]. Br J Dermatol 1995; 131(Suppl 44):38–39.

20. Attanoos RL, Appleton MA, Douglas Jones AG. The pathogenesis of hidradenitis suppurativa: a closer look at apocrine and apoeccrine glands. Br J Dermatol 1995; 133:254–258.
21. Jemec GBE, Hansen U. The histology of hidradenitis suppurativa. J Am Acad Dermatol. 1996; 34:994–999.
22. Plewig G, Steger M Acne inversa (alias acne triad, acne tetrad or hidradenitis) In: Marks R, Plewig G, eds. Acne and related disorders, 1st ed. London: Martin Dunitz, 1989, pp 345–347.
23. Rodder Wehrmann O, Kuster W, Plewig G. [Acne inversa. Diagnosis and therapy]. Hautarzt 1991; 42:5–8.
24. Jansen T, Plewig G. What's new in acne inversa (alias hidradnitis suppurativa)? J Eur Acad Dermatol 2000; 14:342–343.
25. Jemec GBE, Gniadecka M. Sebum excretion rate and clinical markers of androgenicity in patients with hidradenitis suppurativa. Dermatology 1997; 194:325–329.
26. Fitzsimmons JS, Fitzsimmons EM, Gilbert G. Familial hidradenitis suppurativa: evidence in favour of single gene transmission. J Med Genet 1984; 21:281–285.
27. Lookingbill DP. Yield from complete skin examination. J Am Acad Dermatol 1988; 18:31–37.
28. Jemec GBE. The symptomatology of hidradenitis suppurativa in women. Br J Dermatol 1988; 119:345–350.
29. Jemec GBE, Heidenheim M, Nielsen NH. The prevalence of hidradenitis suppurativa and its potential precursor lesions. J Am Acad Dermatol 1996; 35:191–194.
30. Jemec GBE, Heidenheim M, Nielsen NH. A case-control study of hidradenitis suppurativa in a STD population. Acta Derm Venereol 1996; 76:482–483.
31. Nevitt GJ, Hutchinson PE. Psoriasis in the community: prevalence, severity and patients' beliefs and attitudes towards the disease. Br J Dermatol 1996; 135:533–537.
32. Reedy LM, Mallett R, Freeman RG. Hidradenitis suppurativa in a female Shetland sheep dog. Vet Med Small Anim Clin 1973; 68:1261–1262.
33. Cunliffe WJ. Acne. London: Martin Dunitz, 1989.
34. Plewig G, Kligman AM. Acne and Rosacea, 2nd ed. Berlin: Springer Verlag, 1993.
35. O'Loughlin S, Woods R, Kirke PN, et al. Hidradenitis suppurativa. Glucose tolerance, clinical, microbiologic, and immunologic features and HLA frequencies in 27 patients. Arch Dermatol 1988; 124:1043–1046.
36. Lapins J, Olerup O, Emtestam L. No human leukocyte antigen -A, -B or DR association in Swedish patients with hidradenitis suppurativa. Acta Derm Venereol 2001; 81:28–30.
37. Fitzsimmons JS, Guilbert PR, Fitzsimmons EM. Evidence of genetic factors in hidradenitis suppurativa. Br J Dermatol 1985; 113:1–8.
38. von der, Werth J, Williams HC. The natural history of hidradenitis suppurativa. J Eur Acad Dermatol 2000; 14:389–393.
39. Gower Rousseau C, Maunoury V, Colombel JF, et al. Hidradenitis supporativa and Crohn's disease in two families: a significant association? Am J Gastroenterol 1992; 87:928.
40. Burrows NP, Jones RR. Crohn's disease in association with hidradenitis suppurativa. Br J Dermatol 1992; 126:523.
41. Osdere LS, Langtry JA, Mortimer PS, et al. Hidradenitis suppurativa in Crohn's disease. Br J Dermatol 1991; 125:384–386.
42. Balus L, Fazio M, Amantea A, et al. [Dowling-Degos disease and Verneuil disease]. Ann Dermatol Venereol 1993; 120:705–708.
43. Church JM, Fazio VW, Lavery IC, et al. The differential diagnosis and comorbidity of hidradenitis suppurativa and perianal Crohn's disease. Int J Colorectal Dis 1993; 8:117–119.
44. Attanoos RL, Appleton MA, Hughes LE, et al. Granulomatous hidradenitis suppurativa and cutaneous Crohn's disease. Histopathology 1993; 23:111–115.
45. Tsianos EV, Dalekos GN, Tzermias C, et al. Hidradenitis suppurativa in Crohn's disease. A further support to this association. J Clin Gastroenterol 1995; 20:151–153.
46. Randazzo L, Puig L, De Moragas JM. Hidradenitis suppurativa associated with bowel Crohn's disease. Actas Dermo sifilogr 1995; 86:153–157.
47. Dvorak VC, Root RK, MacGregor RR. Host-defense mechanisms in hidradenitis suppurativa. Arch Dermatol 1977; 113:450–453.
48. Ginder PA, Ousley M, Hinthorn D, et al. Hidradenitis suppurativa: evidence for a bactericidal defect correctable by cholinergic agonist in vitro and in vivo. J Clin Immunol 1982; 2:237–241
49. Lapins J, Asman B, Gustafsson A, et al. Neutrophil-related host response in hidradenitis suppurativa—a pilot study in patients with inactive disease. Acta Derm Venereol 81(2):96–99.
50. Cornbleet T. Pregnancy and apocrine gland diseases: Hidradenitis, Fox-Fordyce disease. Arch Dermatol Syph 1952; 65:12–20.
51. Ebling FJ. Hidradenitis suppurativa: an androgen-dependent disorder. Br J Dermatol 1986; 115:259–262.
52. Barth JH, Ng LL, Wojnarowska F, et al. Acanthosis nigricans, insulin resistance and cutaneous virilism. Br J Dermatol 1988; 118:613–619.
53. Harrison BJ, Read GF, Hughes LE. Endocrine basis for the clinical presentation of hidradenitis suppurativa. Br J Surg 1988; 75:972–975.
54. Mortimer PS, Dawber RP, Gales MA, et al. Mediation of hidradenitis suppurativa by androgens. Br Med J Clin Res Ed 1986; 292:245–248.
55. Gee BC, Dawber RP. Hidradenitis suppurativa. J R Soc Med 2000; 93:661.
56. Lewis F, Messenger AG, Wales JK. Hidradenitis suppurativa as a presenting feature of premature adrenarche. Br J Dermatol 1993; 129:447–448.
57. Chalmers RJ, Ead RD, Beck MH, et al. Acne vulgaris and hidradenitis suppurativa as presenting features of acromegaly. Br Med J Clin Res Ed 1983; 287:1346–1347.
58. Mengesha YM, Holcombe TC, Hansen RC. Prepubertal hidradenitis suppurativa: Two case reports and a review of the literature. Pediatr Dermatol 1999; 16:292–296.
59. Woods G, Vogel EH, Cronk J. Hidradenitis suppurativa and pregnancy. Case report and discussion. Ohio State Med J 1972; 68:864–866.
60. Barth JH, Layton AM, Cunliffe WJ. Endocrine factors in pre- and postmenopausal women with hidradenitis suppurativa. Br J Dermatol 1996; 134:1057–1059.
61. Jemec GBE, Gniadecka M. Regional sebum excretion rates in hidradenitis suppurativa. Dermatology 1997; 194:325–329.
62. Abrahamsson L, Hackl H, Sugn J, et al. [Clinical results and hormonal aspects of the treatment of virilizing symptoms in women with cyproterone acetate]. Wien Klin Wochenschr 1979; 91:126–130.
63. Mortimer PS, Dawber RP, Gales MA, et al. A double-blind controlled cross-over trial of cyproterone acetate in females with hidradenitis suppurativa. Br J Dermatol 1986; 115:263–268.
64. Sawers RS, Randall VA, Ebling FJ. Control of hidradenitis suppurativa in women using combined antiandrogen (cyproterone acetate) and oestrogen therapy. Br J Dermatol 1986; 115:269–274.
65. Farrell AM, Randall VA, Dawber RP. Finasteride as a therapy for hidradenitis suppurativa. Br J Dermatol 1999; 141:1138–1139.
66. Thuboutor DM, Knaggs H, Gilliland K, et al. Activity of 5 alpha-reductase is greater in the follicular infrainfundibulum compared with the epidermis. Br J Dermatol 1997; 136:166–171.
67. Lumniss PJ, Jenkins PJ, Besser GM, et al. Gender differences in incidence of idiopathic fistula-in-ano are not explained by circulating sex hormones. Int J Colorectal Dis 1995; 10:25–28.
68. Stellon AJ, Wakeling M. Hidradenitis suppurativa associated with use of oral contraceptives. Br Med J 1989; 298:28–29.
69. Jemec GBE, Heidenheim M. The influence of sex hormones on UVB induced erythema in man. J Dermatol Sci 1995; 9:221–224.
70. Hermansson A. Surgical treatment of axillary hidradenitis suppurativa. Scand J Plast Reconstr Surg 1982; 16:163–165.
71. Edlich RF, Silloway KA, Rodeheaver GT, et al. Epidemiology, pathology, and treatment of axillary hidradenitis suppurativa. J Emerg Med 1986; 4:369–378.
72. Wiltz O, Schoetz Jr DJ, Murray JJ, et al. Perianal hidradenitis suppurativa. The Lahey Clinic experience. Dis Colon Rectum 1990; 33:731–734.
73. Stone OJ. Hidradenitis suppurativa following acanthosis nigricans. Report of two cases. Arch Dermatol 1976; 112:1142.
74. Jemec GBE, Heidenheim M, Nielsen NH. Hidradenitis suppurativa: Characteristics and consequences. Clin Exp Dermatol 1996; 21:419–423

75. Jemec GBE Body weight in hidradenitis suppurativa. In: Marks R, Plewig G, eds. Acne and related disorders. London: Martin Dunitz, 1989, pp 375–376.
76. Highet AS, Warren RE, Weekes AJ. Bacteriology and antibiotic treatment of perineal suppurative hidradenitis. Arch Dermatol 1988; 124:1047–1051.
77. Anke H, Senst W. [Contribution on the etiology and therapy of sweat gland abscess (hidradenitis suppurativa)]. Z Arztl Fortbild (Jena) 1968; 62:426–429.
78. Highet AS, Warren RE, Staughton RCD, et al. *Streptococcus milleri* causing treatable infection in perineal hidradenitis suppurativa. Br J Dermatol 1980; 103:375–382.
79. Finegold S, Summanen P, Gerardo SH, et al. Clinical importance of *Bilophila wadsworthia*. Eur J Clin Microbiol Infect Dis 1992; 11:1058–1063.
80. Baron EJ, Curren M, Henderson G, et al. *Bilophila wadsworthia* isolates from clinical specimens. J Clin Microbiol 1992; 30:1882–1884.
81. Leach RD, Eykyn SJ, Phillips I, et al. Anaerobic axillary abscess. Br Med J 1979; 2:5–7.
82. Till AE, Layton AM, Barth JH, et al. *Staphylococcus lugdunensis* isolated from axillary apocrine glands of hidradenitis suppurativa patients. J Invest Dermatol 1995; 104:618.
83. Jemec GBE, Faber M, Gutschick E, et al. Microbiology of hidradenitis suppurativa. Dermatology 1996; 193:203–206.
84. Lapins J, Jarstrand C, Emtestam L. Coagulase-negative staphylococci are the most common bacteria found in cultures from the deep portions of hidradenitis suppurativa lesions, as obtained by carbon dioxide laser surgery. Br J Dermatol 1999; 140:90–95.
85. Molnar C, Hevessy Z, Rozgonyi F, et al. Pathogenicity and virulence of coagulase-negative staphylococci in relation to adherence, hydrophobicity, and toxin production in vitro. J Clin Pathol 1994; 47:743–748.
86. Vandenesch F, Eykyn SJ, Etienne J. Infections caused by newly-described species of coagulase-negative staphylococci. Rev Med Microbiol 1995; 6:94–100.
87. Brendahan J, Paran H, Kolman S, et al. The possible role of *Chlamydia trachomatis* in perineal suppurative hidradenitis. Eur J Surg 1992; 158:213–215.
88. Cosman B, O'Grady TC, Pekarske S. Verrucous carcinoma arising in hidradenitis suppurativa. Int J Colorectal Dis 2000; 15:342–346.
89. Egawa K, Honda Y, Inaba I. Detection of human papillomaviruses in eccrine ducts in palmoplantar epidermal cysts. Br J Dermatol 1995; 132:533–542.
90. Gupta AK, Ellis CN, Nickoloff BJ, et al. Oral cyclosporine in the treatment of inflammatory and noninflammatory dermatoses. A clinical and immunopathologic analysis. Arch Dermatol 1990; 126:339–350.
91. Gupta AK, Knowles SR, Gupta MA, et al. Lithium therapy associated with hidradenitis suppurativa: case report and a review of the dermatologic side effects of lithium. J Am Acad Dermatol 1995; 32:382–386.
92. Morgan WP, Leicester G. The role of depilation and deodorants in hidradenitis suppurativa. Arch Dermatol 1982; 118:101–102.
93. Boer J, Weltevreden EF. Hidradenitis suppurativa or acne inversa. A clinicopathological study of early lesions. Br J Dermatol 1996; 135:721–725.
94. König A, Lehman C, Rompel R, et al. Cigarette smoking as a triggering factor of hidradenitis suppurativa. Dermatology 1999; 198:261–264.
95. Rompel R, Petres J. Long-term results of wide surgical excisions in 106 patients with hidradenitis suppurativa. Dermatol Surg 2000; 26:683–643.
96. Lapins J, Ye W, Nyrén O, et al. Incidence of cancer among patients with hirdarenitis suppurativa. Arch Dermatol 2001; 137(6):730–734.
97. Hurley HJ, Shelley WB. Apocrine sweat retention in man. J Invest Dermatol 1954; 16:397–404.
98. Jemec GBE, Thomsen BM, Hansen U. The homogeneity of hidradenitis suppurativa lesions—histological study of intraindividual variation. APMIS 1997; 105:378–383.
99. Jansen T, Plewig G. [Classification of suppurative hidradenitis]. Hautarzt 1994; 45:652–653.
100. Plewig G. Follicular keratinization. J Invest Dermatol 1974; 62:308–315.
101. Yu C, Cook M. Hidradenitis suppurativa: a disease of the follicular epithelium, rather than apocrine glands. Br J Dermatol 1990; 122:763–769.
102. Jemec GBE, Gniadecka M. Ultrasound examination of hair follicles in hidradenitis. Arch Dermatol 1997; 133:967–972.
103. von der Werth J, Jemec GBE. Morbidity in patients with hidradenitis suppurativa. Br J Dermatol 2001; 144:809–814.
104. Jemec GBE, Wendelboe P. A randomised trial of topical clindamycin vs. systemic tetracycline in hidradenitis suppurativa. J Am Acad Dermatol 1998; 39:971–974.
105. Curry SS, Gaither DH, King LE. Squamous cell carcinoma arising in dissecting perifolliculitis of the scalp. A case report and review of secondary squamous cell carcinomas. J Am Acad Dermatol 1981; 4:673–678.
106. Heilberger P, Galli KH, Kreuzpaintner KH. [Pyodermia sinifica fistulans with fatal outcome]. Chirurg 1994; 65:395–398.
107. Tennant Jr F, Bergeron JR, Stone OJ, et al. Anemia associated with hidradenitis suppurativa. Arch Dermatol 1968; 98:138–140.
108. Rosner IA, Richter DE, Huettner TL, et al. Spondyloarthropathy associated with hidradenitis suppurativa and acne conglobata. Ann Intern Med 1982; 97:520–525.
109. Rosner IA, Burg CG, Wisnieski JJ, et al. The clinical spectrum of the arthropathy associated with hidradenitis suppurativa and acne conglobata. J Rheumatol 1993; 20:684–687.
110. Hamnir XL, Francois RJ, van den Haute V, et al. Arthritis and hidradenitis suppurativa diagnosed in a 48-year-old man. Skeletal Radiol 1999; 28:453–456.
111. Gupta S, Kumar B. Dorsal perforation of prepuce: a common end point of severe ulcerative genital diseases? Sex Transm Inf 2000; 76:210–212.
112. Welsh DA, Powers JS. Elevated parathyroid hormone-related protein and hypercalcemia in a patient with cutaneous squamous cell carcinoma complicating hidradenitis suppurativa. South Med J 1993; 86:1403–1404.
113. Moosa HH, McAuley CE, Ramasastry SS. Surgical management of severe mammary hidradenitis suppurativa. Ann Plast Surg 1988; 20:82–85.
114. Konety BR, Cooper T, Flood HD, et al. Scrotal elephantiasis associated with hidradenitis suppurativa. Plast Reconstr Surg 1996; 97:1243–1245.
115. Wrone DA, Landeck A, Dibbell DG, et al. Hidradenitis suppurativa polyposa. Pathol Res Practa 2000; 196:589–592.
116. Zelignan I. Temporary x-ray epilation therapy of chronic axillary hidradenitis suppurativa. Arch Dermatol 1965; 92:690–694.
117. Klug W. Zur Therapie der progredienten Hidradenitis axillaris. München Med Wochenschr 1924; 71:715–723.
118. Rütz A. Über Schwiissdrüsenabszesse der Achselhöhle und ihre Behandlung mit Röntgenstralen. Med Klin 1924; 20:672–673.
119. Fröhlich D, Baaske D, Glatzel M. [Radiotherapy of hidradenitis suppurativa—still valid today?]. Strahlenther Onkol 2000; 176:286–289.
120. Clemmensen OJ. Topical treatment of hidradenitis suppurativa with clindamycin. Int J Dermatol 1983; 22:325–328.
121. Van Landuyt H, Laurent R. [Suppurative hidradenitis]. Ann Dermatol Venereol 1990; 117:59–61.
122. Camisa C, Sexton C, Friedman C. Treatment of hidradenitis suppurativa with combination hypothalamic–pituitary–ovarian and adrenal suppression. A case report. J Reprod Med 1989; 34:543–546.
123. Bogers JW, Minderhoud Bassie W, Huikeshoven FJ. A case of hidradenitis suppurativa treated with gonadotropin-releasing hormone agonist and by total abdominal hysterectomy with bilateral salpingo-oophorectomy. Am J Obstet Gynecol 1992; 167:517–518.
124. Goldsmith PC, Dowd PM. Successful therapy of the follicular occlusion triad in a young woman with high dose oral antiandrogens and minocycline. J R Soc Med 1993; 86:729–730.
125. Kipping HF. How I treat hidradenitis suppurativa. Postgrad Med 1970; 48:291–292.
126. Buckley DA, Rogers S. Cyclosporin-responsive hidradenitis suppurativa. J R Soc Med 1995; 88:289P–290P.
127. Martinez F, Nos P, Benlloch S, et al. Hidradenitis suppurativa and Crohn's disease: Response to treatment with infliximab. Inflammatory Bowel Dis 2001; 7:323–327.

128. Martinez P, Nos P, Belloch S, Ponce J. Hidradenitis suppurativa and Crohn's disease: response to treatment with infliximab. Inflamm Bowel Dis 2001; 7:323–326.
129. Fearfiled LA, Staughton RSD. Severe vulval apocrine acne successfully treated with prednisolone and isotretinoin. Clin Exp Dermatol 1999; 24:189–192.
130. Jones DH, Cunliffe WJ, King K. Hidradenitis suppurativa—lack of success with 13-cis-retinoic acid. Br J Dermatol 1982; 107:252.
131. Harms M. [Treatment of acne with orally administered isotretinoin. Clinical study of 56 patients.]. Schweiz Med Wochenschr 1983; 113:1549–1554.
132. Wishart JM. Systemic treatment of severe acne with a retinoic acid derivative, Isotretinoin. N Z Med J 1984; 97:115–117.
133. Dicken CH, Powell ST, Spear KL. Evaluation of isotretinoin treatment of hidradenitis suppurativa. J Am Acad Dermatol 1984; 11:500–502.
134. Norris JFB, Cunliffe WJ. Failure of treatment of familial widespread hidradenitis suppurativa with isotretinoin. Clin Exp Dermatol 1986; 11:579–583.
135. Brown CF, Gallup DG, Brown VM. Hidradenitis suppurativa of the anogenital region: response to isotretinoin. Am J Obstet 1988; 158:12–15.
136. Deroo H, Aelbrecht M, t'Kindt J, et al. Hidradenitis suppurativa. Dermatologica 1990; 180:193–194.
137. Hogan DJ, Light MJ. Successful treatment of hidradenitis suppurativa with acitretin. J Am Acad Dermatol 1988; 19:355–356.
138. Chow ETY, Mortimer PS. Successful treatment of hidradenitis suppurativa and retroauricular acne with etretinate [letter]. Br J Dermatol 1922; 126:415.
139. Green C. Spontaneous bruising during treatment with isotretinoin [letter]. Br J Dermatol 1993; 128:465.
140. Souteyrand P, Roger H. Traitement des acnés nodulo-kystiques sévères et des hidrosadénites suppurées par l'acie 13-cis rétinoïque (isotrétinoïne) Nouv Dermatol 1996; 5(Suppl 4):363–366.
141. Boer J, van Gemert MJ. Long-term results of isotretinoin in the treatment of 68 patients with hidradenitis suppurativa. J Am Acad Dermatol 1999; 40:73–76.
142. Jemec BI. [Chronic suppurative hidradenitis of the genito-femoral region]. Ugeskr Laeger 1983; 145:660–661.
143. Ritz JP, Runkel N, Haier J, et al. Extent of surgery and recurrence rate of hidradenitis suppurativa. Int J Colorectal Dis 1998; 13:164–168.
144. Lapins J, Marcusson JA, Emtestam L. Surgical treatment of chronic hidradenitis suppurativa: CO_2 laser stripping—second intention technique. Br J Dermatol 1994; 131:551–556.
145. Lapins J, Sartorius K, Emtestam L. Scanner-assisted carbon dioxide laser surgery—a retrospective follow-up of patients with hidradenitis suppurativa. J Am Acad Dermatol 2002; 47:280–285.
146. Morgan WP, Harding KG, Richardson G, et al. The use of silastic foam dressing in the treatment of advanced hidradenitis suppurativa. Br J Surg 1980; 67:277–280.
147. Morgan WP, Harding KG, Hughes LE. A comparison of skin grafting and healing by granulation, following axillary excision for hidradenitis suppurativa. Ann R Coll Surg Engl 1983; 65:235–236.
148. Morgan JM, Alvarez RD, Hatch KD. Delayed split-thickness skin grafting after radical excision in the treatment of advanced hidradenitis suppurativa of the vulva and perianus. J Gynecol Surg 1990; 6:129–134.
149. Jemec GBE. The effect of localised surgical excisions in hidradenitis suppurativa. J Am Acad Dermatol 1988; 19:1103–1107.
150. Harrison BJ, Mudge M, Hughes LE. Recurrence after surgical treatment of hidradenitis suppurativa. Br Med J Clin Res Ed 1987; 294:487–489.
151. Knaysi GA, Cosman B, Crikelair GF. Hidradenitis suppurativa. J Am Med Assoc 1968; 203:73–76.
152. Wallenberg L, Åberg M. Surgical therapeutic techniques in chronic suppurative recrudescing hidradenitis. Läkertidningen 1981; 78:2071–2072.
153. Broadwater JR, Bryant RL, Petrino RA, et al. Advanced hidradenitis suppurativa. Am J Surg 1982; 144:668–670.
154. Soldin MG, Tulley P, Kaplan H, et al. Chronic axillary hidradenitis—the efficacy of wide excision and flap coverage. Br J Plast Surg 2000; 53:434–436.
155. Bohn J, Svensson H. Surgical treatment of hidradenitis suppurativa. Scan J Plast Reconstr Hand Surg 2001; 5:305–309.

Hidradenitis Suppurativa

Gregor B. E. Jemec

Journal of Cutaneous Medicine and Surgery
DOI: 10.1007/s10227-002-2104-z
J Cutan Med Surg 2003; 47-56

Division of Dermatology, Department of Medicine, Roskilde Hospital, Roskilde, Denmark.
Online publication: 4 December 2002
Correspondence to: Gregor B.E. Jemec, Division of Dermatology, Department of Medicine, Roskilde Hospital, DK-4000, Roskilde, Denmark. E-mail: ccc2845@vip.cybercity.dk

Abstract

Background: Hidradenitis Suppurativa is a clinically defined disease that causes considerable morbidity for patients. The results of recent studies, which have increased the understanding of this disease are reviewed.

Objective: The epidemiology, risk factors, pathogenesis and treatment of this disease are summarized to help clinicians with practical patient management.

Conclusion: Hidradenitis Suppurativa remains a clinical challenge to patients and physicians alike. Physicians should be familiar with the impact this disease has on the patient and with the range of treatments available. Use of simple incisions as treatment is strongly discouraged. Additional pathogenic as well as therapeutic studies are necessary.

Sommaire

Antecedent: L'hidrosadenite supparante est une entite clinique bien definie qui est une cause important de morbidite. Les resultats d'etudes recentes qui ont accru la comprehension de cette maladie sont revus dans cette etude.

Objectifs: L'epidemiologie, les facteurs de risque, la pathogenicite, et la traitement de cette maladie sont resumes dans le but d'aider la gestion pratique de ces patients.

Conclusion: L'hidrosadenite suppurante reste un defi clinique a la fois pour les patients et pour les medecins. Les praticiens devraient de plus se familiariser avec l'impacte de cette maladie sure le patient et avec les traitements disponibles. Les lecteurs sont dissuades d'utiliser de simples incisions comme traitement. Des etudes pathogeniques et therapeutiques supplementaires sont necessaires.

Hidradenitis suppurativa (HS) is a clinical entity based on a clinical definition. The diagnostic criteria are wide and usually include scarring, the recurrent nature of the disease, and the characteristic multifocal location restricted to the axillae, inframmaary region, and groin.[1] Inflamed pilonidal cysts and staphylococcosis are the most common differential diagnoses, but rarer differential diagnoses such as multiple trichoepitheliomas, steatocystoma multiplex, and apocrine nevus exist.[2-4] A staging classification of hidradenitis has been proposed by Hurley.[5] The Hurley classification describes the evolution of the disease from early localized inflammation to fulminant disease (Fig.1).

No pathognomic signs exist, but clues to the diagnosis are provided by the distribution of the lesions and their clinical appearance. Early studies stressed the shape of the lesions, describing them as characteristically rounded rather than pointed as seen in furunculosis, the lack of central necrosis, and the “deep” location.[6,7]

Definition

Hidradenitis Suppurativa is a recurrent disease, restricted to inverse areas, and is characterized by a progression from noninflamed nodules to painful, rounded, deep-seated inflamed lesions and subsequent scarring and chronic suppuration (Fig. 1). Nodules are restricted to the skin and may persist for years with occasional episodes of inflammation. Inflamed nodules progress into scarred lesions when spontaneously draining dermal sinus tracts appear. Sinus tracts persist and cause periodic flares of inflammation. The end stage is characterized by widespread scarring in the region.

FIGURE 1 (Photo omitted)

Photo caption: Typical hidradenitis suppurative. Recurrent abscesses with tract formation and cicatrization. Single or multiple, widely separated lesions.

Nosology

Classification of diseases or nosology is important for our understanding of the pathological processes and subsequent clinical management of disease. HS was first described by Velpeau in 1839 (quoted in ref. 8) based on the characteristic distribution of the lesions, i.e., the "anatomical predisposition" of the affected regions. Later, Verneuil[8] described the clinical course and suggested an association with the sweat glands which were particularly "well developed" and "voluminous" in the affected areas. He identified HS as a subcutaneous process and distinguished it from furunculosis.

This idea was perpetuated until Pillsbury coined the term "follicular occlusion" suggesting that acne vulgaris, perifolliculitis capitis, pilionidal cysts and hidradenitis are closely related diseases involving the hair follicle. [9-12] Clinical manifestations and response to treatment, however remain very different, e.g., acne prominently involves the sebaceous apparatus while HS does not. [13,14] The continued publication of case reports of the follicular occlusion triad also suggests that co-occurence is rare. [15-17] Even if the diseases are not identical, they may share pathogenic steps involving the hair follicle. Human experiments by Shelly and Cahn[18] reproduced HS-like lesions in healthy volunteers after occlusion of the hair follicles, and the concept is further supported by recent histological studies.[19-21] Some authors are now proposing that the term hidradenitis be abolished in favor of a new term "acne inversa." [22-25] The distinction between the new acne inversa and the old follicular occlusion triad is unclear and thus both theoretical and practical problems remain associated with this new concept.

Epidemiology

Studies have estimated the prevalence at 1/3000 without specifying a time frame or specific diagnostic criteria.[26] In a study of the "hidden" or "unrecognized" dermatological diseases in patients attending a dermatological clinic, a physical examination of general dermatological patients found a point prevalence of hidradenitis at a rate of 1/1000.[27] From interviews among healthy women (mean age 31 years), a lifetime prevalence rate of 4% was found.[28] The women interviewed were all hospital employees (nurses and students) and therefore may have overreported events in comparison to the general population.

Later studies of a population sample in Denmark, using the proposed combined clinical definition of positive signs and symptoms and exclusion criteria, found that hidradenitis was more common than previously estimated, with a point prevalence of 4.1% (3.0-6.0%) in a younger adult population.[29,30] A one-year prevalence of 1% (0.4-2.2%) in the general population was based on the subjects' recollection only and is similar to that of other major dermatoses, e.g., psoriasis.[29-31]

Active hidradenitis is generally more prevalent in women with an odds ratio of 2.9.[29,30] Active genitofemoral lesions occur significantly more often in female patients, while no sex difference is seen in the rarer axillary lesions. Noninflamed quiescent nodules are also more prevalent in women and in genitofemoral lesions. Comedones have been suggested as precursor lesions for HS, but, in contrast to the manifested disease, they appear to be equally distributed in both sexes and sites.

Etiology and Pathogenic Factors

A limited number of investigations into the etiology of hidradenitis have been made. Hidradenitis has been described in dogs, but no experimental studies are available using a canine model of the disease.[32]

Genetic Factors

HS patients report cases among their relatives more frequently than controls, and families in which hidradenitis, acne, and other poral occlusion diseases occur have been reported.[15,28,33,34] However specific genetic studies have yielded conflicting results. One study has suggested that inherited factors may be important in hidradenitis following HLA-typing in 27 patients, although the results did not reach statistical significance due to the small number of patients used.[35] A later and larger study of HLA in Swedish patients compared with a population sample did not find any HLA-A, HLA-B, HLA-DR association.[36] One study describing an autosomal dominant pattern of inheritance has also been reported but the penetrance appeared variable, indicating that other non-genetic factors are involved. [26,37] A later review of the data has renewed the suspicion of a dominant pattern of inheritance in this group of patients using a better clinical definition of the cases.[38]

Co-occurence of phenotypes may support a genetic linking. In case reports or series of case reports, hidradenitis has been associated with a number of diseases. Most frequently, association with Crohn's disease (n=34) and Dowling-Dego's disease (n=8) has been reported.[39-46] However, it is unclear to what extent these reports truly reflect hidradenitis lesions as defined in the above, and even if these observations represent causal relationships or merely the coincidental findings of a comparatively common disease such as hidradenitis.

Immunological Host Factors

An immunological etiology of HS has been considered a possible predisposing factor to bacterial infection. One study failed to identify immune deficiency in HS patients,

although individual patients may be found in whom correctable bactericidal effects can be identified.[47-48] It should be noted that disease definition in this case was poor. Immunology may also play a role independent of bacteria. A pilot study suggested that excessive free oxygen radical generation by neutrophils from HS patients may be an etiologic factor, although the data are preliminary and require additional verification.[49] Similar mechanisms have previously been implied in paradentosis and inflammatory bowel disease which share histological features with HS.

Hormonal Factors

Hyperandrogenic syndromes are clinically expressed in women.[50-55] A clear female proponderance exists in HS. It appears to occur exclusively in adults, but it may occur as the presenting feature of adrenarche (n=5) or with acne in acromegaly (n=1). [56-58]

Premenstrual flareup is reported in several studies by approximately 50% of women with hidradenitis, while improvement is reported by only a minority.[54,59,60] Flareups may be absent in anovulatory cycles.[53] Pregnancy and childbirth are also reported to infuence the intensity of disease favorably with subsequent postpartum flarup.[28,50] Reduced fecundity in some patients may be causally related to the changes in circulating sex hormones, but correlation with clinical markers of hyperandrogenism is poor.[28]

Careful studies of cutaneous signs of virilism, including sebum secretion rate, have failed to show any significant abnormalities in hidradenitis patients, further supporting a localized androgen effect.[61] However it should be noted that the variation in hirsutism and acne scores in hidradenitis patients was larger than in healthy controls, which may suggest that a subpopulation of patients exists in whom signs of cutaneous virilism are more pronounced and where androgens may play a pathogenic role.[61] Antiandrogenic treatment has been found to be effective in some cases and in one randomized controlled trial.[62-65] The mechanism behind this effect is not clear. In a published measurement of circulating androgens, a considerable overlap to normal values was found, suggesting that end-organ sensitivity may be involved and it has been suggested that infrainfundibular keratinocytes have an increased capacity for androgen metabolism which may play a role in follicular hyperkeratinization.[66] There have also been studies which failed to show any abnormalities of circulating androgens in hidradenitis.[60,67]

The main weaknesses with the articles relating to androgen involvement are the possible confusion with acne conglobata with HS and the wide range in the level of circulating androgen which shows a large number of patients with normal or low androgen levels. A number of patients diagnosed in these studies also had extensive acne lesions, leading to the speculation that what was interpreted as hidradenitis was in fact acne, an acknowledged androgen sensitive disorder. Finally, the possible pathogenic role of androgens is further confounded by early reports suggesting that testosterone can be used in the treatment of hidradenitis.[9] The exact role of androgens in HS therefore remains to be established.

The use of oral contraceptives may also affect potential androgen-dependent disease.[68] The pattern of use among patients was not different from that of the general population. Finally, the female preponderance may also be explained by other sex-specific factors such as the oestrogenic influence on inflammation.[69]

Obesity

Obesity has often been suggested as an etiological factor.[52,70-73] Previous studies have shown conflicting results: one study found HS patients to be more obese (n=11),[71] another study was unable to reproduce the findings (n=76).[74,75] It is suggested that while obesity may not be a primary pathogenic factor, it may aggravate preexisting hidradenitis through mechanical irritation, occlusion, and maceration.

Infection

Bacteria have traditionally been implicated in hidradenitis. Early histological studies suggested staphylococci to be causally involved, and, although later studies have seperated staphylococcosis and hidradenitis as two different clinical entities, topical and systemic antibiotics are still used in the treatment of hidradenitis.[1,76]

Routine microbiological culture of lesions is frequently negative, although more extensive investigations have managed to identify a number of different bacteria in lesions diagnosed as hidradenitis: staphylococci, *S. lugdeniensis, Strep Milleri, Bilophila wadsworthia*, and anaerobes.[35,77-82] The species have been isolated from a wide range of lesions at many different stages and definitions of hidradenitis. Frequently, the different species of bacteria have also been found in only a few cases as a part of more general investigations of the flora of skin infections.[78-80]

Sampling problems may have influenced the results of these studies. Needle aspiration of early lesions has yielded recognized pathogens in a minority of examined lesions (9/41; *S. Aureus* in 8/41 lesions and *S. Milleri* in 1/41).[83] Patients seek medical help sooner if their lesions contain *S. aureus* than if their lesions contain other bacteria or are sterile. A more recent study has attempted to overcome the sampling problems by using laser ablation to expose the HS lesions before sampling.[84] Using this technique, the involved structures can be visualized before sampling and thus the sampling error is abolished. In the study,[84] positive cultures were found in all the examined patients, with *Staph. aureus* and coagulase-negative staphylococci found most frequently.[84] Therefore it is speculated that coagulase-

negative staphylococci play a pathogenic role. These bacteria are known to produce clinically significant infections in association with nonvital tissue and artificial implants or allografts.[85,86] In HS an analogous situation may exist in conjunction with the spillover of follicular material from ruptured hair follicles. IgG precipitins have been studied as an indirect measure of bacterial involvement in HS.[83] No association between precipitins and bacteria was found, nor did the precipitins clearly differ from normal values. The highest number of precipitins was found against *S. aureus*.

Infections may co-occur with HS. A possible causal association between genitofemoral hidradenitis and *Chlaymdia trachomatis* has been suggested but the organism was not found in the pus of any lesion.[87] A study of patients attending an STD clinic failed to identify any association between *Chlaymdia* infection and HS but suggested that human papilloma virus (HPV) infection was more common in HS patients.[30] It has also been suggested that HPV infection is a cofactor in complications such as malignant degeneration of HS lesions.[88] The possible causal relationship of HPV infection and the primary hidradenitis lesion is obscure, although the virus has been associated with palmar cysts through infection of the distal eccrine duct.[89]

Drugs

Hidradenitis is rarely a side effect of drug use, but oral contraceptives (n=7) and lithium (n=1) have been associated with its development.[68,90,91]

Cosmetics

Early reference suggested a causative role for cosmetics, especially in women shaving their axillae on the assumption that shaving may provide an entry point for bacterial infection.[6,92] Self-reported skin irritation due to cosmetics is significantly more common in HS patients.[28] Two studies have been unable to identify differences in the pattern of use of cosmetics, shaving, or the use of talcum in HS.[28,92] Histological data which could substantiate an irritant component of early HS provide mixed results. One study found infrainfundibular spongiosis in early lesions, while another study found no signs of irritant reactions (spongiosis or parakeratosis).[21,93] The study by Shelley and Cahn[18] has been interpreted to imply a role for cosmetics in HS. They epilated the axillae of 12 healthy volunteers and applied occlusive tape for one week to produce "hidradenitis-like" lesions, which is obviously different from customary use of cosmetics.

Tobacco

Two independent epidemiological studies have suggested that the use of tobacco by HS patients is more common than among healthy controls, although no specific mechanism has been identified to link the use of tobacco with HS.[94,95]

Lung and buccal cancers are more common among HS patients than in the general population as would be expected with increased tobacco smoking or chewing.[96]

Morphology of Hidradenitis Suppurativa

Histology

Hidradenitis is a follicular disease that may secondarily involve other structures such as apocrine or eccrine glands (Fig.2).[21] Occlusion of the hair follicle produces hidradenitis-like lesions,[18] while destruction of the apocrine gland duct orifices produces distended apocrine glands.[97] Pure apocrine gland affection is found in 5% of the cases, predominantly occurring in the axilla, and is clinically indistiguishable from HS.[21] The follicular nature of the disease seen is highlighted by the description of spongiform inflammatory changes of the infrainfundibulum of early lesions.[93] The HS lesions present a consistent histological image as shown in a study of multiple biopsies from individual patients.[98]

Sinus tracts have been heralded as the hallmark of hidradenitis and used to further underline the similiarities between hidradenitis and acne.[24,99] It is not clear whether sinus tract formation is a host-specific response pattern of or a specific trait connected to the diagnosis of hidradenitis. Sinus tracts have been experimentally produced in the rhino-mouse by inserting a trans-dermal suture from one distended follicle to another, suggesting that it is related to the host rather than to the stimulus.[100]

Based on published histological studies, it is suggested that HS is an inflammatory disease originating from the hair follicle and subsequently spreading inflammation to the surrounding tissues where characteristic secondary changes develop.[21,101] Sinus tract formation is speculated to represent reparitive mechanisms that encapsulate necrotic debris, and, with abnormal hair follicles, sinus tracts may create the morphological prerequisites for the subsequent chronic, recurrent course of the disease.

FIGURE 2 (photo omitted)

Caption: Histology of hidradenitis suppurativa. Lesions show inflammatory infiltrate surrounding hair follicles (top), while apocrine glands are unaffected (bottom).

High-Frequency Ultrasound

Normal hair follicles appear as elongated, parallel, low echogenic structures occurring at regular intervals within the dermis and oriented at an angle of approximately 45°-60° to the surface of the skin as seen in normal histological

specimens. In HS, changes have been found in the clinically uninvolved axillary and genitofemoral hair follicles. The follicles appear to be of a larger diameter and a distorted shape with a wider deep follicular diameter, in agreement with the clinical impression that the primary event in HS is deep-seated rather than superficial.[102]

Consequences and Complications

HS causes significant morbidity. The general self-reported level of health is poorer among HS patients; the average Danish patient lost 2.7 days of work per year (stages I and II) due to flareups of HS.[74] Similarly, the quality of life is lower than any other dermatological disease studied using the DLQI for assessment of life quality.[103] The data strongly support the clinical impression that HS is a "heart sink" condition for patients.

The soreness, discharge, and appearance of lesions are described as problems in both work and leisure activities by 51% of all patients. For grades I and II, the main problem is soreness, which can be used to assess the efficacy of treatment.[74,104]

A number of case reports exist describing rare but serious complications. Death due to HS has occurred (n=2).[105,106] Non-lethal complications range from anemia to increased white blood cells.[107] HS-associated arthritis, axial spondyloarthropathy, and sterile osteomyelitis-like lesions also occur but do not appear to be associated with HLA B27.[108-110]

Rare complications include benign and malignant ulcers arising from chronic hidradenitis (n=37).[88,111] Squamous cell carcinomas originating from HS lesions may be associated with hypercalcemia.[112] A general association between HS and cancer was confirmed in a nationwide case-control study involving all Swedish HS patients admitted to hospital between 1987 and 94.[96] It was shown that HS patients have a higher overall incidence of cancer (1.5; 1.1-1.8) than the general population. The incidence of nonmelanoma skin cancer standard incidence rate (SIR) =4.6; 1.5-10.70, buccal (SIR= 5.5; 1.8-12.9), and hepatic cancer (SIR= 10.0; 2.1-29.1) was increased.

Finally, there are complications caused by the chronic inflammation of hidradenitis extending to surrounding tissues e.g., edema of the scrotum or breast, fistulas, anorectal abscesses, and polypoid outgrowths.[67, 113-115]

Treatment

Physical or Adjuvant Treatment

Early studies stressed the usefulness of wet warm compresses, unspecified ointments, and sulphur. As an indication of the clinical difficulties of treating hidradenitis, it may be noted that some of these treatments are still used today.[1] The avoidance of mechanical stress on the surface of the skin, i.e., shear forces, is also commonly recommended, although no experimental evidence exists to support the advice. It has been speculated that the abnormally thick skin and dystrophic hair follicles are more susceptible to mechanical stresses, but no experiment has yet been designed to test this hypothesis.

Radiotherapy

A body of early literature supports the use of X rays in depilatory doses and a total dose of 1.5-18 Gy. A dosage giving temporary epilation has been suggested as optimal by Zeligman.[116] The dosage given in a single-session treatment schedule was 4-5 Gy (100kV, 100 mA, 0.8-mm A1 filter), reportedly with good effect and without subsequent irradiation dermatitis or scarring. This suggests that improved drainage of the follicle may be of importance to the clinical effect, although the locally immunosuppressive effect may also play a role.[117-119] No randomized controlled trials (RCTs) have been conducted in this field. The possible beneficial effects of laser epilation do, however suggest that hair removal may be of independent importance (personal observation, G.B.E. Jemec).

Antibiotics

It has been pointed out that the standard length of antibiotic treatment closely resembles the duration of untreated flares in HS.[38] However, antibiotics continue to be widely used in the treatment of hidradenitis. They are used as both monotherapy and in conjunction with surgery. While they are of crucial importance in the treatment of concomitant bacterial infection, antibiotics role vis-a-vis HS is currently as unclear as the role of bacteria in the disease.[95]

Topical clindamycin has been shown to have an effect in a double-blinded placebo-controlled study (n=30). A significant reduction of symptoms was seen within one month of treatment ($p < 0.01$). A subsequent 3-month double-blinded double-dummy study comparing topical clindamycin with systemic tetracyclin (n=34) failed to show significant differences between the two treatments.[104,120]

Hormonal Therapy

The possible beneficial effects of testosterone is a curious contrast to the results of a double-blinded crossover trial which found cyproterone acetate useful.[9,63,64,121]

Cyproterone acetate in combination with enthinylestradiol is the only other treatment, apart from topical clindamycin that has been shown to have an effect in a controlled trial. A dose of 50 ug ethinyloestradiol/50 mg cyproterone acetate was compared with 50 ug ethinyloestradiol/500 ug norgestrel and found to be superior, with 29% of patients (7/24) clearing completely and 21% (5/24) improving within a 18-month followup period.[63]

Finasteride may also have an effect[65] as may more aggressive manipulation of the sex hormones, e.g., the use of gonadotropin-releasing agonists in combination with oophorecto-salpingecto-hysterectomy.[122,123] Combination therapy with antiandrogens and antibiotics has also been reportedly successful.[124]

Immunosuppressive Treatment

Since the disease is not a classic infectious disease universally caused by known pathogens, simple antiinflammatory treatment offers great relief for many patients. ACTH, hydrocortisone, azathioprine, and cyclosporin have all been used with good effect.[45, 90, 125, 126] Prednisolone may be used as adjuvant treatment, for periodic sytemic therapy to treat flareups (personal communication, Dr. J. von der Werth) or intralesionally.[127] More specific, targeted therapy using infliximab has been reported in a case, and it may hold more promise for future therapy.[128] Appropriate bacteriological sampling must be obtained if antiinflammatory therapy is instituted.

Recently the successful outcome of dapsone treatment has been reported.[129]

Retinoids

Retinoids have been tested in a number of case reports. No double-blinded design studies have been published. The predominant number of publications deal with the use of isotretinoin in a dosage similar to acne treatment, but reports have also been published on the use of etretinate and acitretin.[25, 45, 121, 130-140] Etretinate and acitretin may have an effect in patients who are unresponsive to isotretinoin.[138]

The biggest case series (n=68) suggests that less than 25% of HS patients derive benefit from isotretinoin therapy, although it has been suggested that a longer treatment period may be necessary than in acne.[130, 141] One review has suggested that patients in which hidradenitis occurred in conjunction with acne lesions on convex areas of the body, i.e., acne conglobata with lesions in inverse regions, were more responsive than patients in whom lesions were confined to the inverse regions.[131]

Surgery

Removal of the lesions through surgery is strongly recommended at an early stage of the disease. The published data on the efficacy of different methods are neither uniform nor extensive; a more uniform reporting would therefore improve the usefulness of future reports.

Simple lancing is ineffectual and should actively be discouraged.[5, 142, 143] An improved technique involves exteriorization of the lesion.[5] Proper exteriorization involves removal of the "roofs" of sinus tracts, removal of all granulation tissue by curratage, and healing by secondary intention. A similar result can be achieved by CO2 laser evaporation of the tissue. This method allows visualization of the lesions during the procedure and therefore may be less invasive that cold steel surgery. Good results have been reported with low recurrence rates and healing times of 3-5 weeks.[144, 145]

Specific factors appear to influence the risk of recurrence:

The Extent of the Excision

Single-lesion treatment offers lower immediate morbidity, while larger excisions may offer a better prognosis. Long-term followup of simple excision has shown a wide range of recurrence rates (see Table 1). This reflects two aspects of surgical treatment: First, when single or adjacent elements are excised, recurrences do occur locally even after sugery; second, patients may develop new foci of hidradenitis in another region. Local recurrences may appear either rapidly and in direct association with the scar, suggesting that diseased tissue had been left at the time of operation, or over a longer period suggesting *de novo* occurrence of disease. The appearance of new foci strongly suggest the disease is intrinsically multifocal.

The Method of Closure

It has been argued that better results can be obtained by leaving wounds to secondary healing rather than direct closure by apposition, flaps, or grafts. In studies of secondary healing, scarring has not been reported.[146-148] For large lesions this method is slow, and even though modern bandaging provides good clinical results and improved ease of management, morbidity can still be considerable for a protracted period. Healing periods of several months can be expected following large excisions.

Location

In addition to the extent of excision, the location may be of importance to the outcome of surgery, with perianal and axillary surgery having a lower recurrence rate than inguinoperineal or submammary excision.[149, 150] It remains to be seen if the regional differences are merely a secondary factor to the size of the primary excision.

Patient Age

This may also play a role, with older patients having lower recurrence rates irrespective of the preoperative duration.[149, 150]

Table 1
Reported results of surgery*

Method of closure	*Region*	*Followup Months (range)*	*Recurrence Rates*	*Year (ref.)*
Primary closure	Mixed	38 (? - ?)	21% (5/24)	1968 (151)
SSG	Mixed	38 (? - ?)	4% (2/53)	–
Flap	Mixed	38 (? - ?)	22% (2/9)	–
Primary closure	Mixed	-120	42% (18/43)	1981 (152)
SSG or Flap	Mixed	-120	0% (0/42)	–
Incision	Mixed	n.a.	83% (10/12)	1982 (153)
Primary closure	Mixed	n.a.	30% (3/10)	–
SSG	Mixed	n.a.	13% (3/24)	–
Secondary healing or SSG	Mixed	47 (6-89)	24% (19/82)	1987 (150)
Primary closure	Mixed	54 (12-132)	78%	1988 (149)
Secondary healing	Mixed	27 (15-47)	25% (6/24)	1994 (144)
Incision	Mixed	72 (? - ?)	100% (6/6)	1998 (143)
Primary closure	Mixed	72 (? - ?)	53% (8/14)	–
SSG or Secondary healing	Mixed	72 (? - ?)	27% (3/11)	–
Mixed	Mixed	36 (6 - ?)	2.5%	2000 (95)
Local excision (primary, flaps, or SSG)	Axillae	n.a.	27% (7/26)	2000 (154)
Hair-bearing skin (primary, flaps, or SSG)	Axillae	n.a.	7% (3/29)	–
Hair-bearing skin + 2 cm (flaps or SSG)	Axillae	n.a.	0% (0/29)	–
Lesion + 2 cm to the fascia	Axillae/groin	96 (0-252)	???	2001 (155)

* SSG = split-skin graft, n.a. = not available

For chronic recurrent diseases, patient satisfaction with any given therapeutic modality is particularly important. No data are available on patient satisfaction with medical treatment, but it is generally found to be high following any kind of surgical treatment. Early and aggressive treatment is therefore recommended as are additional RCTs in this disheartening disease.

References

1. Highett AS, Hay RJ, Roberts SOB. Bacterial infections In: Champion RH, Burton JL, Ebling FJG, eds. Textbook of dermatology 5th ed. Oxford: Blackwell Scientific Publications, 1990, pp 953-1031

2. D'Souze M, Garg BR, Ratnaker C, et al Multiple trichoepitheliomas with rare features. J. Dermat 1994; 21:582-585

3. Gollhausen R, Besenhard HM, Ruzicka T. (Steatocystoma multiplex conglobatum). Hautarzt 1988; 39: 177-179

4. Naill JS, Park HK, Apocrine nevus: light microscopic, immunohistochemical and ultrastructural studies of a case. J Cutan Pathol 1983; 20: 79-83

5. Hurley HJ. Axillary hyperhidrosis, apocrine bromhidrosis, hidradenitis suppurative and familial benign pemphigus. Surgical approach. In: Roenigk RK, Roenigk HHJ, eds. Dermatologic surgery. Principles and Practice. New York: Marcel Dekker, 1989, pp717-743

6. Tachau P, et al Schweissdrusenpyodermien In: Biberstein H, Fuchs D, Jadassohn J, eds. Handbuch der Haut- und Geschlechtskrankheiten. Berlin; Julius Springer, 1934, pp 375-392.

7. Mortimer PS, Lunniss PJ. Hidradenitis Suppurativa. J R Soc Med. 2000; 93(8):420-422

8. Verneuil A. De l'Hidrosadénite Phlegmoneuse Et Des Abcés Sudoripares. Arch Gén Méd. 1864; 24(537-557)

9. Cornbleet T. Testosterone for Apocrine Diseases: Hidrosadenitis, Fox-Fordyce Disease. AMA Arch Derm Syphilol. 1952; 65(5):549-552.

10. Brunsting HA. Hidradenitis Suppurativa; Abscess of the Apocrine Sweat Glands. Arch Dermatol Syphilol. 1939; 39:108-120.

11. Ebling FJ. Apocrine glands in health and disorder Int J Dermatol 1989; 28:508-511.

12. Pillsbury DM, Shelly WB, Kligman AM, Bacterial infections of the skin. In: Pillsbury DM ed. Dermatology, 1st ed. Philadelphia: W.B.Saunders, 1956 pp 482-484,489.

13. Stedman TL. Stedmans medical dictionary, 25th ed. Baltimore: Williams and Wilkins, 1990.

14. Ackerman B, et al Acne conglobata/acne keloidas/dissecting cellulitis of the scalp/hidradenitis suppurativa. In: Ackerman B, Chongchitnant S, Sanches J, eds Histologic diagnosis of inflammatory skin diseases, 2nd ed. Baltimore: Williams and Wilkins, 1997, pp 174-176.

15. Zisova L, Sakakushev B. Acne Tetrad in a Family. Folia Med (Plovdiv). 1994; 36(4):51-57.

16. Mittal RR, Gill SS, Jot T. Follicular occlusion triad. Indian J Dermatol Venereol Leprol 1993; 59: 88-89

17. Boyd AS, Zemtsov A. A Case of Pyoderma Vegetans and the Follicular Occlusion Triad. J Dermatol. 1992; 19(1):61-63.

18. Shelley WB, Cahn,MM. The Pathogenesis of Hidradenitis Suppurativa in Man AMA Arch Derm. 1955; 72(6):562-565.

19. Layton AM, Pace D, Cunliffe WJ et al. A prospective histological study of acute hidradenitis suppurativa (abstract) Br J Dermatol 1995; 131(Suppl 44): 38-39

20. Attanoos RL, Appleton MA, Douglas-Jones AG. The Pathogenesis of Hidradenitis Suppurativa: A Closer Look at Apocrine and Apoeccrine Glands. Br J Dermatol. 1995;133(2):254-258.

21. Jemec GB, Hansen U. Histology of Hidradenitis Suppurativa. J Am Acad Dermatol.1996; 34(6):994-999.

22. Plewig G, Steger M. Acne inversa (alias acne triad, acne tetrad or hidradenitis) In: Marks R, Plweig G, eds. Acne and related disorders, 1st ed. London; Martin Dunitz,1989, pp 345-347.

23. Rodder-Wehrmann O, Kuster W, Plewig G. Acne Inversa. Diagnosis and Therapy.Hautarzt. 1991; 42(1):5-8.

24. Jansen T, Plewig G. What's New in Acne Inversa (Alias Hidradenitis Suppurativa)? J Eur Acad Dermatol 2000; 14(5):342-343.

25. Jemec GB, Gniadecka M. Sebum Excretion in Hidradenitis Suppurativa. Dermatology.1997; 194(4):325-328.

26. Fitzsimmons JS, Fitzsimmons EM, Gilbert G. Familial Hidradenitis Suppurativa: Evidence in Favour of Single Gene Transmission. J Med Genet. 1984; 21(4):281-285.

27. Lookingbill DP. Yield from a complete skin examination. J Am Acad Dermatol. 1988 Jan;18:31-7.

28. Jemec GB. The Symptomatology of Hidradenitis Suppurativa in Women. Br J Dermatol.1988; 119(3):345-350.

29. Jemec GB, Heidenheim M, Nielsen NH. The Prevalence of Hidradenitis Suppurativa and its Potential Precursor Lesions. J Am Acad Dermatol. 1996; 35(2 Pt 1):191-194.

30. Jemec GB, Heidenheim M, Nielsen NH. A Case-Control Study of Hidradenitis Suppurativa in an STD Population. Acta Derm Venereol. 1996; 76(6):482-483.

31. Nevitt GJ, Hutchinson PE. Psoriasis in the community; prevalence, severity and patients' beliefs and attitudes toward the disease. Br j Dermatol 1996; 135:533-537.

32. Reedy LM, Mallett R, Freeman RG. Hidradenitis Suppurativa in a Female Shetland Sheep Dog. Vet Med Small Anim Clin. 1973; 68(11):1261-1262.

33. Cunliffe WJ. Acne. London: Martin Dunitz, 1989.

34. Plewig G, Kligman AM. Acne and Rosacea, 2nd ed. Berlin: Springer Verlag, 1993.

35. O'Loughlin S, Woods R, Kirke PN, Shanahan F, Byrne A, Drury MI. Hidradenitis Suppurativa. Glucose Tolerance, Clinical, Microbiologic, and Immunologic Features and HLA Frequencies in 27 Patients. Arch Dermatol. 1988; 124(7):1043-1046.

36. Lapins J, Olerup O, Emtestam L. No Human Leukocyte Antigen-A, -B Or -DR Association in Swedish Patients with Hidradenitis Suppurativa. Acta Dermatovenereologica. 2001; 81(1):28-30.

37. Fitzsimmons JS, Guilbert PR, Fitzsimmons EM. Evidence of Genetic Factors in Hidradenitis Suppurativa. Br J Dermatol. 1985; 113(1):1-8.

38. von der Werth JM, Williams HC. The Natural History of Hidradenitis Suppurativa. J Eur Acad Dermatol Venereol. 2000; 14(5):389-392.

39. Gower-Rousseau C, Maunoury V, Colombel JF, et al. Hidradenitis Suppurativa and Crohn's Disease in Two Families: A Significant Association? Am J Gastroenterol. 1992; 87(7):928.

40. Burrows NP, Jones RR. Crohn's Disease in Association with Hidradenitis Suppurativa. Br J Dermatol. 1992; 126(5):523.

41. Ostlere LS, Langtry JA, Mortimer PS, Staughton RC. Hidradenitis Suppurativa in Crohn's Disease. Br J Dermatol. 1991; 125(4):384-386.

42. Balus L, Fazio M, Amantea A, Menaguale G. Dowling-Degos Disease and Verneuil Disease. Ann Dermatol Venereol. 1993; 120(10):705-708.

43. Church JM, Fazio VW, Lavery IC, Oakley JR, Milsom JW. The Differential Diagnosis and Comorbidity of Hidradenitis Suppurativa and Perianal Crohn's Disease. Int J Colorectal Dis. 1993; 8(3):117-119.

44. Attanoos RL, Appleton MAC, Hughes LE. Granulomatous Hidradenitis Suppurativa and Cutaneous Crohn's Disease. Histopathology. 1993; 23(2):111.

45. Tsianos EV, Dalekos GN, Hatzis J. Hidradenitis Suppurativa in Crohn's Disease: A further Support to this Association. J Clin Gastroenterol. 1995; 20(2):151.

46. Randazzo L, Puig L, De Moragas JM. Hidradenitis Suppurativa associated with bowel Crohn's disease. Actas Dermo sifologr 1995;86:153-157.

47. Dvorak VC, Root RK, MacGregor RR. Host-Defense Mechanisms in Hidradenitis Suppurativa. Arch Dermatol. 1977; 113(4):450-453.

48. Ginder PA, Ousley M, Hinthorn D, Liu C, Abdou NI. Hidradenitis Suppurativa: Evidence for a Bactericidal Defect Correctable by Cholinergic Agonist in Vitro and in Vivo. J Clin Immunol. 1982; 2(3):237-241.

49. Lapins J, Asman B, Gustafsson A, Bergstrom K, Emtestam L. Neutrophil-Related Host Response in Hidradenitis Suppurativa: A Pilot Study in Patients with Inactive Disease. Acta Dermatovenereologica. 2001; 81(2):96-99.

50. Cornbleet T. Pregnancy and Apocrine Gland Diseases: Hidradenitis, Fox-Fordyce Disease. AMA Arch Derm Syphilol. 1952; 65(1):12-19.

51. Ebling FJ. Hidradenitis Suppurativa: An Androgen-Dependent Disorder. Br J Dermatol. 1986; 115(3):259-262.

52. Barth JH, Ng LL, Wojnarowska F, Dawber RP. Acanthosis Nigricans, Insulin Resistance and Cutaneous Virilism. Br J Dermatol. 1988; 118(5):613-619.

53. Harrison BJ, Read GF, Hughes LE. Endocrine Basis for the Clinical Presentation of Hidradenitis Suppurativa. Br J Surg. 1988; 75(10):972-975.

54. Mortimer PS, Dawber RP, Gales MA, Moore RA. Mediation of Hidradenitis Suppurativa by Androgens. Br Med J (Clin Res Ed). 1986; 292(6515):245-248.

55. Gee BC, Dawber RP. Hidradenitis Suppurativa. Journal- Royal Society of Medicine. 2000; 93(12):661.

56. Lewis F, Messenger AG, Wales JK. Hidradenitis Suppurativa as a Presenting Feature of Premature Adrenarche. Br J Dermatol. 1993; 129(4):447-448.

57. Chalmers RJ, Ead RD, Beck MH, Dewis P, Anderson DC. Acne Vulgaris and Hidradenitis Suppurativa as Presenting Features of Acromegaly. Br Med J (Clin Res Ed). 1983; 287(6402):1346-1347.

58. Mengesha YM, Holcombe TC, Hansen RC. Prepubertal Hidradenitis Suppurativa: Two Case Reports and Review of the Literature. Pediatr Dermatol. 1999; 16(4):292-296.

59. Woods G, Vogel EH, Croak J. Hidradenitis Suppurativa and Pregnancy. Case Report and Discussion. Ohio State Med J. 1972; 68(9):864-866.

60. Barth JH, Layton AM, Cunliffe WJ. Endocrine Factors in Pre- and Postmenopausal Women with Hidradenitis Suppurativa. Br J Dermatol. 1996; 134(6):1057-1059.

61. Jemec GB, Gniadecka M. Sebum Excretion in Hidradenitis Suppurativa. Dermatology. 1997; 194(4):325-328.

62. Abrahamsson L, Hackl H, Sogn J, Stafsnes H. Clinical Results and Hormonal Aspects of the Treatment of Virilizing Symptoms in Women with Cyproterone Acetate (Author's Transl). Wien Klin Wochenschr. 1979; 91(4):126-130.

63. Mortimer PS, Dawber RP, Gales MA, Moore RA. A Double-Blind Controlled Cross-Over Trial of Cyproterone Acetate in Females with Hidradenitis Suppurativa. Br J Dermatol. 1986; 115(3):263-268.

64. Sawers RS, Randall VA, Ebling FJ. Control of Hidradenitis Suppurativa in Women using Combined Antiandrogen (Cyproterone Acetate) and Oestrogen Therapy. Br J Dermatol. 1986; 115(3):269-274.

65. Farrell AM, Randall VA, Vafaee T, Dawber RP. Finasteride as a Therapy for Hidradenitis Suppurativa. Br J Dermatol. 1999; 141(6):1138-1139.

66. Thiboutot DM, Knaggs H,Gilliland K et al Activity of 5a reductase is greater in the follicular infrainfundibulum compared with the epidermis. Br J Dermatol 1997; 136:166-171

67. Lunniss PJ, Jenkins PJ, Besser GM, Perry LA, Phillips RK. Gender Differences in Incidence of Idiopathic Fistula-in-Ano are Not Explained by Circulating Sex Hormones. Int J Colorectal Dis. 1995; 10(1):25-28.

68. Stellon AJ, Wakeling M. Hidradenitis Suppurativa Associated with use of Oral Contraceptives. Br Med J. 1989; 298(6665):28.

69. Jemec GB, Heidenheim M. The influence of sex hormones on UVB induced erythema in man. Dermatol Sci. 1995 May;9(3):221-4.

70. Hermanson A. Surgical Treatment of Axillary Hidradenitis Suppurativa. Scand J Plast Reconstr Surg. 1982; 16(2):163-165.

71. Edlich RF, Silloway KA, Rodeheaver GT, Cooper PH. Epidemiology, Pathology, and Treatment of Axillary Hidradenitis Suppurativa. J Emerg Med. 1986; 4(5):369-378.

72. Wiltz O, Schoetz DJ,Jr, Murray JJ, Roberts PL, Coller JA, Veidenheimer MC. Perianal Hidradenitis Suppurativa. the Lahey Clinic Experience. Dis Colon Rectum. 1990; 33(9):731-734.

73. Stone OJ. Hidradenitis Suppurativa Following Acanthosis Nigricans. Report of Two Cases. Arch Dermatol. 1976; 112(8):1142.

74. Jemec GBE, Heidenheim M, Nielson NH. Hidradenitis Suppurativa: Characteristics and consequences. Clin Exp Dermatol 1996;21:419-423.

75. Jemec GBE, Body weight in Hidradenitis Suppurativa In: Marks R, Plewig G eds. Acne and related disorders. London: Martin Dunitz, 1989, pp 375-376.

76. Highet AS, Warren RE, Weekes AJ. Bacteriology and Antibiotic Treatment of Perineal Suppurative Hidradenitis. Arch Dermatol. 1988; 124(7):1047-1051.

77. Anke H, Senst W. Contribution on the Etiology and Therapy of Sweat Gland Abscess (Hidradenitis Suppurativa). Z Arztl Fortbild (Jena). 1968; 62(8):426-429.

78. Highet AS, Warren RE, Staughton RC, Roberts SO. Streptococcus Milleri Causing Treatable Infection in Perineal Hidradenitis Suppurativa. Br J Dermatol. 1980; 103(4):375-382.

79. Finegold S, Summanen P, Hunt Gerardo S, Baron E. Clinical Importance of Bilophila Wadsworthia. Eur J Clin Microbiol Infect Dis. 1992; 11(11):1058-1063.

80. Baron EJ, Curren M, Henderson G, et al. Bilophila Wadsworthia Isolates from Clinical Specimens. J Clin Microbiol. 1992; 30(7):1882-1884.

81. Leach RD, Eykyn SJ, Phillips I, Corrin B, Taylor EA. Anaerobic Axillary Abscess. Br Med J. 1979; 2(6181):5-7.

82. Till AE, Layton AM, Barth JH et al Staphylococcus lugdunensis isolated from axillary apocrine glands of hidradenitis suppurativa patients. J Invest Dermatol 1995;104:618.

83. Jemec GBE, Faber M, Gutschick E, Wendelboe P. Microbiology of Hidradenitis Suppurativa. Journal of the European Academy of Dermatology and Venereology. 1995; 5(1001):88-88.

84. Lapins J, Jarstrand C, Emtestam L. Coagulase-Negative Staphylococci are the most Common Bacteria found in Cultures from the Deep Portions of Hidradenitis Suppurativa Lesions, as obtained by Carbon Dioxide Laser Surgery. Br J Dermatol.1999;140(1):90-95.

85. Molnar C, Hevessy Z, Rozgonyi F et al. Pathogenicity and virulence of coagulase negative staphylococci in relation to adherance, hydrophobicity, and toxin production in vitro. J Clin Pathol 1994;47: 743-748

86. Vandenesch F, Eykn SJ, Etienne J. Infections caused by newly-described species of coagulase-negative staphylococci. Rev Med Microbiol 1995; 6:94-100.

87. Brendahan J, Paran H, Kolman S etal. The possible role of chlamydia trachomatis in perineal suppurative hidradenitis. Eur J. Surg 1992; 158:213-215

88. Cosman BC, OGrady TC, Pekarske S. Verrucous Carcinoma Arising in Hidradenitis Suppurativa. Int J Colorectal Dis. 2000; 15(5/6):342-346.

89. Egawa K, Honda Y, Inaba J. Detection of human papillomaviruses in eccrine ducts in palmoplantar epidermal cysts. Br J Dermatol 1995; 132:533-542.

90. Gupta AK, Ellis CN, Nickoloff BJ, et al. Oral Cyclosporine in the Treatment of Inflammatory and Noninflammatory Dermatoses. A Clinical and Immunopathologic Analysis. Arch Dermatol. 1990; 126(3):339-350.

91. Gupta AK, Knowles SR, Gupta MA, Jaunkalns R, Shear NH. Lithium Therapy Associated with Hidradenitis Suppurativa: Case Report and a Review of the Dermatologic Side Effects of Lithium. J Am Acad Dermatol. 1995; 32(2 Pt 2):382-386.

92. Morgan WP, Leicester G. The Role of Depilation and Deodorants in Hidradenitis Suppurativa. Arch Dermatol. 1982; 118(2):101-102.

93. Boer J, Weltevreden EF. Hidradenitis Suppurativa Or Acne Inversa. A Clinicopathological Study of Early Lesions. Br J Dermatol. 1996; 135(5):721-725.

94. Konig A, Lehmann C, Happle R. Cigarette Smoking as a Triggering Factor of Hidradenitis Suppurativa. Dermatology. 1999; 198(3):261.

95. Rompel R, Petres J. Long-Term Results of Wide Surgical Excision in 106 Patients with Hidradenitis Suppurativa. Dermatol Surg. 2000; 26(7):638-643.

96. Lapins J, Ye W, Nyren O, Emtestam L. Incidence of Cancer among Patients with Hidradenitis Suppurativa. Arch Dermatol. 2001; 137(6):730-734.

97. Hurley HJ, Shelley WB. Apocrine sweat retention in man. J Invest Dermatol 1954;16:397-404.

98. Jemec GB, Thomsen BM, Hansen U. The Homogeneity of Hidradenitis Suppurativa Lesions. A Histological Study of Intra-Individual Variation. APMIS. 1997; 105(5):378-383.

99. Jansen T, Plewig G. Classification of Suppurative Hidradenitis. Hautarzt. 1994; 45(9):652-653.

100. Plewig G. follicular keratinization J Invest Dermatol 1974;62:308-315.

101. Yu CC, Cook MG. Hidradenitis Suppurativa: A Disease of Follicular Epithelium, rather than Apocrine Glands. Br J Dermatol. 1990; 122(6):763-769.

102. Jemec GB, Gniadecka M. Ultrasound Examination of Hair Follicles in Hidradenitis Suppurativa. Arch Dermatol. 1997; 133(8):967-970.

103. von der Werth JM, Jemec GB. Morbidity in Patients with Hidradenitis Suppurativa. Br J Dermatol. 2001; 144(4):809-813.

104. Jemec GBE, Wendelboe P. Topical Clindamycin Versus Systemic Tetracycline in the Treatment of Hidradenitis Suppurativa. J Am Acad Dermatol. 1998; 39(6):971.

105. Curry SS, Gaither DH, King LE,Jr. Squamous Cell Carcinoma Arising in Dissecting Perifolliculitis of the Scalp. A Case Report and Review of Secondary Squamous Cell Carcinomas. J Am Acad Dermatol. 1981; 4(6):673-678.

106. Heilberger P, Galli KH, Kreuzpaintner KH. Pyodermia Sinifica Fistulans with Fatal Outcome. Chirurg. 1994; 65(4):395-8; discussion 398-9.

107. Tennant F,Jr, Bergeron JR, Stone OJ, Mullins JF. Anemia Associated with Hidradenitis Suppurativa. Arch Dermatol. 1968; 98(2):138-140.

108. Rosner IA, Richter DE, Huettner TL, Kuffner GH, Wisnieski JJ, Burg CG. Spondyloarthropathy Associated with Hidradenitis Suppurative and Acne Conglobata. Ann Intern Med. 1982; 97(4):520-525.

109. Rosner IA, Burg CG, Wisnieski JJ, Schacter BZ, Richter DE. The Clinical Spectrum of the Arthropathy Associated with Hidradenitis Suppurativa and Acne Conglobata. J Rheumatol. 1993; 20(4):684-687.

110. Hamoir XL, Francois RJ, Van den Haute V, Van Campenhoudt M. Arthritis and Hidradenitis Suppurativa Diagnosed in a 48-Year-Old Man. Skeletal Radiol. 1999; 28(8):453-456.

111. Gupta S, Kumar B. Dorsal Perforation of Prepuce: A Common End Point of Severe Ulcerative Genital Diseases? Sex Transm Infect. 2000; 76(3):210-212.

112. Welsh DA, Powers JS. Elevated Parathyroid Hormone-Related Protein and Hypercalcemia in a Patient with Cutaneous Squamous Cell Carcinoma Complicating Hidradenitis Suppurativa. South Med J. 1993; 86(12):1403-1404.

113. Moosa HH, McAuley CE, Ramasastry SS. Surgical Management of Severe Mammary Hidradenitis Suppurativa. Ann Plast Surg. 1988; 20(1):82-85.

114. Konety BR, Cooper T, Flood HD, Futrell JW. Scrotal Elephantiasis Associated with Hidradenitis Suppurativa. Plast Reconstr Surg. 1996; 97(6):1243-1245.

115. Wrone DA, Landeck A, Dibbell DG, Xie H, Warner TF. Hidradenitis Suppurativa Polyposa. Pathol Res Pract. 2000; 196(8):589-592; discussion 593-4.

116. Zeligman I. Temporary x-Ray Epilation Therapy of Chronic Axillary Hidradenitis Suppurativa. Arch Dermatol. 1965; 92(6):690-694.

117. Klug W. Zur Therapie der progredienten Hidradenitis Axillaris. Munchen Med Wochenschr 1924; 71:715-723.

118. Rutz A. Uber Schwiissdrusenabszesse der Achselhohle und ihre Bahandlung mit Rontgenstralen. Med Klin 1924;20:672-673

119. Frohlich D, Baaske D, Glatzel M. Radiotherapy of Hidradenitis Suppurativa--Still Valid Today? Strahlenther Onkol. 2000; 176(6):286.

120. Clemmensen OJ. Topical Treatment of Hidradenitis Suppurativa with Clindamycin. Int J Dermatol. 1983; 22(5):325-328.

121. Van Landuyt H, Laurent R. Suppurative Hidradenitis. Ann Dermatol Venereol. 1990; 117(1):59-61.

122. Camisa C, Sexton C, Friedman C. Treatment of Hidradenitis Suppurativa with Combination Hypothalamic-Pituitary-Ovarian and Adrenal Suppression. A Case Report. J Reprod Med. 1989; 34(8):543-546.

123. Bogers JW, MinderhoudBassie W, Huikeshoven FJM. A Case o Hidradenitis Suppurativa Treated with Gonadotropin-Releasing Hormone Agonist and by Total Abdominal Hysterectomy with Bilateral Salpingo-Oophorectomy. Am J Obstet Gynecol. 1992; 167(2):517.

124. Goldsmith PC, Dowd PM. Successful Therapy of the Follicular Occlusion Triad in a Young Woman with High Dose Oral Antiandrogens and Minocycline. J R Soc Med. 1993; 86(12):729-730.

125. Kipping HF. How I Treat Hidradenitis Suppurativa. Postgrad Med. 1970; 48(3):291-292.

126. Buckley DA, Rogers S. Cyclosporin-Responsive Hidradenitis Suppurativa. J R Soc Med. 1995; 88(5):289P-290P.

127. Martinez F, Nos P, Benlloch S, Ponce J. Hidradenitis Suppurativa and Crohn's Disease: Response to Treatment with Infliximab. Inflamm Bowel Dis. 2001; 7(4):323-326.

128. Martinez F, Nos P, Benlloch S, Ponce J. Hidradenitis Suppurativa and Crohn's Disease: Response to Treatment with Infliximab. Inflamm Bowel Dis. 2001; 7(4):323-326.

129. Fearfield LA, Staughton RC. Severe Vulval Apocrine Acne Successfully Treated with Prednisolone and Isotretinoin. Clin Exp Dermatol. 1999; 24(3):189-192.

130. Jones DH, Cunliffe WJ, King K. Hidradenitis Suppurativa-Lack of Success with 13-Cis-Retinoic Acid. Br J Dermatol. 1982; 107(2):252.

131. Harms M. Treatment of Acne with Orally Administered Isotretinoin. Clinical Study of 56 Patients. Schweiz Med Wochenschr. 1983; 113(42):1549-1554.

132. Wishart JM. Systemic Treatment of Severe Acne with a Retinoic Acid Derivative, Isotretinoin. N Z Med J. 1984; 97(750):115-117.

133. Dicken CH, Powell ST, Spear KL. Evaluation of Isotretinoin Treatment of Hidradenitis Suppurativa. J Am Acad Dermatol. 1984; 11(3):500-502.

134. Norris JF, Cunliffe WJ. Failure of Treatment of Familial Widespread Hidradenitis Suppurativa with Isotretinoin. Clin Exp Dermatol. 1986; 11(6):579-583.

135. Brown CF, Gallup DG, Brown VM. Hidradenitis Suppurativa of the Anogenital Region: Response to Isotretinoin. Am J Obstet Gynecol. 1988; 158(1):12-15.

136. Deroo H, Aelbrecht M, t'Kindt J, Vermander F, De Bersaques J. Hidradenitis Suppurativa. Dermatologica. 1990; 180(3):193-194.

137. Hogan DJ, Light MJ. Successful Treatment of Hidradenitis Suppurativa with Acitretin. J Am Acad Dermatol. 1988; 19(2 Pt 1):355-356.

138. Chow ET, Mortimer PS. Successful Treatment of Hidradenitis Suppurativa and Retroauricular Acne with Etretinate. Br J Dermatol. 1992; 126(4):415.

139. Green C. Spontaneous Bruising during Treatment with Isotretinoin. Br J Dermatol. 1993; 128(4):465.

140. Souteyrand P, roger H. Traitement dea acnes nodulo-kystiques severes et des hidrosadenites suppurees par l'acie 13-cis retinoique (isotretinoin) Nouv Dermatol 1996; 5(Suppl 4):363-366

141. Boer J, van Gemert MJ. Long-Term Results of Isotretinoin in the Treatment of 68 Patients with Hidradenitis Suppurativa. J Am Acad Dermatol. 1999; 40(1):73-76.

142. Jemec BI. Chronic Suppurative Hidradenitis of the Genito-Femoral Region. Ugeskr Laeger. 1983; 145(9):660-661.

143. Ritz JP, Runkel N, Haier J, Buhr HJ. Extent of Surgery and Recurrence Rate of Hidradenitis Suppurativa. Int J Colorectal Dis. 1998; 13(4):164-168.

144. Lapins J, Marcusson JA, Emtestam L. Surgical Treatment of Chronic Hidradenitis Suppurativa: CO2 Laser Stripping-Secondary Intention Technique. Br J Dermatol. 1994; 131(4):551-556.

145. Lapins J, Sartorius K, Emtestam L. Scanner-Assisted Carbon Dioxide Laser Surgery: A Retrospective Follow-Up Study of Patients with Hidradenitis Suppurativa. J Am Acad Dermatol. 2002; 47(2):280-285.

146. Morgan WP, Harding KG, Richardson G, Hughes LE. The use of Silastic Foam Dressing in the Treatment of Advanced Hidradenitis Suppurativa. Br J Surg. 1980; 67(4):277-280.

147. Morgan WP, Harding KG, Hughes LE. A Comparison of Skin Grafting and Healing by Granulation, Following Axillary Excision for Hidradenitis Suppurativa. Ann R Coll Surg Engl. 1983; 65(4):235-236.

148. Morgan JM, Alvarez RD, Hatch KD. Delayed split-thickness skin grafting after radical excision in the treatment of advanced hidradenitis suppurativa of the vulva and perianus. J Gynecol Surg 1990; 6:129-134

149. Jemec GB. Effect of Localized Surgical Excisions in Hidradenitis Suppurativa. J Am Acad Dermatol. 1988; 18(5 Pt 1):1103-1107.

150. Harrison BJ, Mudge M, Hughes LE. Recurrence After Surgical Treatment of Hidradenitis Suppurativa. Br Med J (Clin Res Ed). 1987; 294(6570):487-489.

151. Knaysi GA,Jr, Cosman B, Crikelair GF. Hidradenitis Suppurativa. JAMA. 1968; 203(1):19-22.

152. Wallenberg LR, Aberg M. Methods of Surgical Treatment of Chronic Suppurative Recurrent Hidradenitis. Lakartidningen. 1981; 78(20):2071-2072.

153. Broadwater JR, Bryant RL, Petrino RA, Mabry CD, Westbrook KC, Casali RE. Advanced Hidradenitis Suppurativa. Review of Surgical Treatment in 23 Patients. Am J Surg. 1982; 144(6):668-670.

154. 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. 2000;53(5):434-436.

155.Bohn J, Svensson H. Surgical Treatment of Hidradenitis Suppurativa. Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery. 2001; 35(3):305-310.