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Hidradenitis suppurativa

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Hidradenitis suppurativa is a chronic relapsing disorder of the folliculopilosebaceous units (FPSUs). Its negative impact on quality of life is extreme, mainly due to the lack of early recognition, accurate diagnosis, and appropriate management. The support structure of the FPSUs is defective. Under the influence of endogenous reproductive hormones, exogenous hormones, androgens and their precursors in dairy products, and other dietary factors, the follicular unit is plugged and distended by retained keratin. Friction, shearing forces, and pressure lead to rupture and leakage of the ductal contents from the weakened FPSU, causing an inflammatory reaction mediated mainly by the innate immune system. Therapy requires patient comprehension and cooperation, counseling, aggressive hormonal and dietary modification, avoidance of the trauma that leads to rupture, active multimodal anti-inflammatory therapy, and early unroofing and debridement. The full therapeutic program is needed to avoid the aggressive surgery required if the condition is not diagnosed early and managed appropriately.

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Background

Hidradenitis suppurativa (HS) is a chronic, inflammatory, scarring condition involving primarily the intertriginous skin of the axillary, inguinal, inframammary, genital, and perineal areas of the body. It is also referred to as acne inversa (AI).

HS/AI has been erroneously linked to the apocrine sweat glands. The first pathogenic change is in the follicular portion of the folliculopilosebaceous unit (FPSU) [1,2].

HS/AI is characterized by recurrent inflamed deep-seated acneiform nodules that result in abscesses and chronic draining sinus tract formation leading to scarring, disfigurement, and life-altering disability. The lesions classically occur in areas of the skin that host FPSUs.

HS/AI is frequently misdiagnosed as "boils," resulting in delayed diagnosis, fragmented care, and progression to a chronic, disabling condition.

Diagnostic Criteria

1. Typical lesions: Deep-seated painful nodules (blind boils) in early primary lesions, or abscesses, draining sinuses, bridged scars, and "tombstone" open comedones in secondary lesions.
2. Typical topography: Axillae, groin, genitals, perineal and perianal region, buttocks, and infra- and intermammary areas.
3. Chronicity and recurrences.

These three criteria must be met to establish the diagnosis. [3]

These recurrent "boils" do not respond to standard antibiotics like "boils" caused by bacteria. Instead of "pointing" vertically and discharging onto the surface, HS/AI lesions are rounded and tend not to burst. Instead, they rupture horizontally under the skin and tend to track subcutaneously. HS/AI is chronic; 90% of patients in one study had the disease an average of 19 years [4,5].

Questions help differentiate HS from other disorders (Table 1).

Table 1
Questions to help diagnosis HS.

1. Does anyone in your family have the same symptoms?
2. Do the "boils" recur in the same spots?
3. Do you smoke or use tobacco products?
4. Do your "boils" flare before your menstrual period?
5. Have the treatments received been helpful?
6. Do you get a fever with these "boils"?
7. Do you have infections elsewhere?

HS/AI patients normally respond yes to 1–4 and no to 5–7 (Adapted from Poli F, Jemec GB, Revuz J. In: Hidradenitis Suppurativa. Jemec, Revuz and Leyden, Eds. Chapter 3, Page 22, Table 3.2).

Differential diagnosis

HS/AI has an extensive differential diagnosis [6] (Table 2). The appearance, age of onset, typical locations, poor response to antibiotics, and lack of signs of systemic sepsis – these can help distinguish this condition, so the diagnosis should be fairly obvious. Anogenital Crohn disease and HS/AI may be associated and confused with each other [4].

The most common differential diagnoses are the follicular pyodermas – folliculitis, furuncles, and carbuncles.

The varied sites of involvement and the rather nonspecific lesions take patients to many specialists. Patients seen in emergency departments are often treated with simple incision and drainage and a short course of antibiotics. This is generally ineffective in controlling the disorder and discouraging for patients [7]. Delayed diagnosis (averaging 7 years) is common.

Table 2
Differential diagnosis.

• Infections
Bacterial
Carbuncles, furuncles, abscesses, ischiorectal/perirectal abscess, Bartholin's duct abscess
Mycobacteria – tuberculous abscess
Sexually transmitted infections – granuloma inguinale, lymphogranuloma venereum, noduloulcerative syphilis
Deep fungi – blastomycosis, nocardiosis
• Tumors
Cysts – epidermoid, Bartholin's, pilonidal
– steatocystoma multiplex
• Miscellaneous
Crohn's
Anal or vulvovaginal fistulae

Prevalence and epidemiology

HS/AI is not "rare." Estimates of global prevalence range between 1% and 4%. Most authors report no racial differences but the female to male ratio is 3.3:1. Women are affected under the breasts (22%) and in the groin (93%); men are affected on the buttocks (40%) and perianal area (51%) [8]. The average age of onset is 23 years. Its onset occurs earlier in those with a family history, and is unusual after menopause. In men, it can continue into old age [9] and is often more severe, and rare squamous cell carcinoma is more common in men.

Etiology

The development of HS/AI depends upon a combination of factors.

Genetic factors

A 35–40% positive family history may reflect inadequate family reporting. An autosomal dominant inheritance pattern has been noted, but no specifically genetic defect has been found. Von der Werth suggests that HS/AI is most likely a heterogeneous disease, probably with several genes involved. [10]

Infection

Bacteria have long been considered in the pathogenesis of HS/AI. It is generally agreed that bacteria do not have a major direct role in the etiology of HS/AI but, as secondary invaders, may share in the pathogenesis of the chronic relapsing lesions causing some of the destructive processes that are seen [11]. Septicemia and systemic illness in this disorder are exceptionally rare.

Hormonal factors

A strong relationship exists between sex hormones and HS/AI. The female preponderance suggests a greater sensitivity of females to androgens. There are no elevations in serum androgens in the vast majority of HS/AI patients. End-organ sensitivity is likely responsible. This highlights the role of FoxO1 in repressing the androgen receptor. Increased access to the androgen receptor is mediated by insulin and insulin-like growth factor-1 (IGF-1), both chronically raised by dietary factors [12].

In women, the onset of HS/AI occurs around menarche, flares premenstrually and following exposure to androgenic progestins like medroxyprogesterone acetate (MPA) or levonorgestrel [13], but improves with pregnancy and fades after menopause.

Antiandrogen therapy helps HS/AI patients of both sexes. Finasteride, a selective inhibitor of the type II isomer of 5α-reductase, reduces the levels of 5α–DHT. It was used to improve six of seven adults with HS/AI and three children, one with premature adrenarche and one with polycystic ovarian syndrome [14].

Immune factors

The disease does not usually produce acute systemic inflammatory effects. There is no fever, rare lymphadenopathy, no septicemia, and occasional local cellulitis, cultures are usually sterile, and, if the offending material beneath the surface is removed, the disease heals without further difficulty and without antibiotics. This is strongly suggestive of inflammation mediated on the local level by the innate immune system. Consider a simple ingrown hair. Flick out the ingrown hair and the inflammation fades.

The immune systems accelerate the disorder. A pathologic examination of excised early lesions demonstrates a wide variety of immune responses involving the innate and acquired (adaptive) immune systems. A vast catalog of T lymphocytes and cytokines are assembled [15]. Unfortunately, cooling the inflammation does not cure the disease.

Mechanical factors

Weakness in the support structure of the follicular portion of the FPSU [16] likely predisposes to follicular rupture caused by local trauma. (Fig. 1) Patients worsen their lesions by pinching them. Obesity contributes to these increases in pressure and shear forces, but the relationship of obesity to dietary habits that raise plasma glucose and insulin levels is more important. This sensitizes the androgen receptors, increases the plugging of pores, causes insulin resistance, and enhances obesity [12]. HS/AI affects thin people but overweight patients have more severe disease.

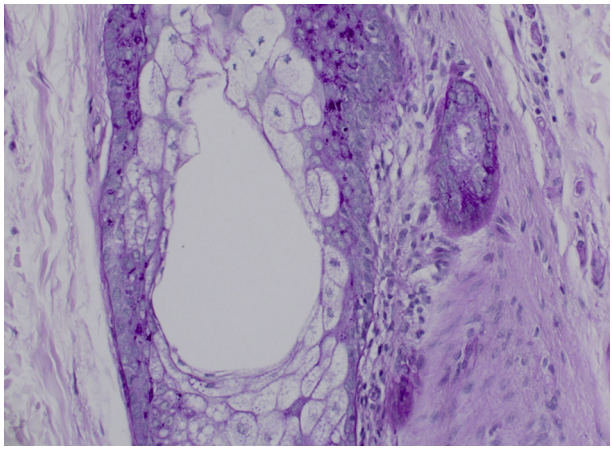

Fig. 1. The supporting material on the left wall of this sebofollicular junction is intact, there is no leak, and no inflammatory activity is attracted to the area. On the right side, where the supporting material is minimal, inflammatory cells congregate at the site of presumed leakage of intraductal contents.

Smoking

Smoking is strongly associated with HS/AI; smokers are generally more severely affected than nonsmokers [17]. Nicotine promotes follicular plugging [18].

Diet

The androgen receptors that control growth are normally closed to circulating androgens. Elevated insulin (from the combination of high glycemic carbohydrate load and dairy whey) and IGF-1 (induced by casein in milk) open these receptors and expose them to circulating androgens [19]. Androgens from

any source can then access previously inaccessible androgen receptors. Stimulation of follicular androgen receptors results in ductal keratinocyte overproduction and retention hyperkeratosis. Androgen sources include the adrenals, ovaries and testes, molecular precursors in dairy products, the androgenic progestins in birth control pills, the levonorgestrel-containing intrauterine device (IUD), intramuscular MPA injections, and contraceptive implants.

Drugs

HS can be triggered or flared by lithium.

Pathogenesis

The pathogenesis of the disease consists of follicular plugging, ductal rupture, and secondary inflammation leading to the downstream changes. HS/AI is subject to genetic, mechanical, hormonal, and other influences [13]. (Fig. 1) The sequential story is likely as follows, though some links remain to be proven.

Patients with HA/AI show an area of weak structural support at the junction of the sebaceous glands and the follicular duct [16]. When hormonal overstimulation of ductal keratinocyte production results in a tight and expanding plug in the duct, centrifugal pressure is applied to this area, and the wall of the duct leaks and ruptures sideways, deep in the dermis. The intraductal follicular contents leak out, stimulating the innate immune system. Healing processes attempt to repair the normal anatomy of the FPSU. (Fig. 1) When repair fails, the follicular fragments stimulate three separate reactions.

The first reaction is the inflammatory response, triggered by the innate immune system. This causes purulence and tissue destruction. It leads to foreign body reactions and extensive scarring.

Second, epithelialized sinuses may develop, postulated to evolve from stem cells (derived from the FPSU) that survive the destruction [20].

Third, an invasive proliferative gelatinous mass (IPGM) is produced in most cases, consisting of a gel in which are embedded both inflammatory cells and, it is postulated, the precursors of the epithelialized elements described above.

Continuous growth of these hormonally stimulated remnants beneath the surface perpetuates the communicating sinuses and inflammatory mass and provides increasing volumes of invading material. The inflammation in the dermis and subcutis will not settle until this material is eliminated.

The onset of the usual lesion occurs as an apparently random, small, red, indurated papule, pustule, or nodule that may resolve without leaving any mark. Onset may take weeks or months, causing vague itching to mild to moderate pain. Acute, severe, even frightening onset may present large, deep, painful lesions, restricting activities. They are generally intertriginous and involve the axillae, inguinal areas, inner thigh, perianal and perineal areas, mammary and inframammary area, buttocks, pubic region, scrotum, vulva, chest, scalp, and the retro-auricular region. The groin, axillae, and under the breasts are involved in women, the axillae, groin, and perianal area in men [10].

Nodules can last anywhere from 7 to 15 days resolving, persisting, or draining to the surface with pain resolution. Patients may present active papules, nodules, and draining sinuses in one area (the groin) and sheets of perifollicular papulopustules elsewhere (around the breasts or buttocks). These lesions come and go.

Secondary lesions develop because the process persists. The subcutaneous coalescence and lateral extension of actively invading epithelial sinuses and proliferative mass, with rupture to the surface, may result in the formation of chronic interlinked sinuses draining serous, purulent, bloody, or a mixed fluid, with or without odor. Persistent ulcerations and even red granulation tissue may surround a sinus opening. With healing, hypertrophic scars and eventually dense rope-like linear fibrotic bands develop. Sinus tracts, some hardly visible, drain serous fluid, or form swollen, painful, and very inflamed subcutaneous networks.

Tertiary lesions from aberrant healing form small pitted or cribriform scars, indolent epidermoid cysts, and sinus tracks that may become hypertrophic and fibrous. These involve entire zones, underlying a solid plaque of thick, bridged, rope-like scars. These can result in contractures, lymphatic obstruction, lymphedema, lymphangiectasia, and verrucous lymphangiomas.

"Tombstone" comedones arise from a burned-out FPSU that has lost its deeper portions. Continued keratinization of the residual follicular stump results in an indolent, shallow, and permanently dilated pore.

Clinical course

The mean age of onset is 22.1 years; it lasts about 19 years [10], can remit or partially remit with pregnancy and breastfeeding, and can be very variable. Usually a benign, mild, chronic but intermittently painful disease, HS/AI has acute exacerbations, premenstrual flares, resolution after menopause, remission for weeks to months, or continuous or intermittent flares. Solid plaques of coalescent nodules, sinuses, and scars host smelly discharge, pain, and debility.

New deep painful nodules last 10–30 days. Patients may present with a certain degree of severity and remain in that range, severe disease usually starting with severe disease from the beginning.

The difficulty with mobility ranges from minor soreness to inability to walk or sit without pain. Odor from drainage may be significant and require diapers, leading to social withdrawal, depression, and dysfunctional lives [21]. The physical extent of HS/AI can be classified using Hurley's clinical staging.

Hurley's stages (Table 3)

Table 3
Hurley stages.

Stage I – abscess formation, single or multiple without sinus tracts and cicatrization (scarring)
Stage II – recurrent abscesses with tract formation and cicatrization, single or multiple widely separated lesions
Stage III – diffuse or near diffuse involvement, or multiple interconnecting tracts and abscesses across entire area.

Revuz documented 68.2% of patients in Hurley's stage I, 27.6% in Hurley's stage II, and 3.9% in Hurley's stage III [9]. From a practical point of view, a patient with Hurley's Stage III really has all three stages and may present with burned-out Stage III but active Stage I or II lesions.

Morbidity/quality of life

HS/AI has a profoundly negative impact on patients' physical, social, and economic lives, with a higher morbidity index than urticaria, neurofibromatosis, psoriasis, atopic dermatitis, mild to moderate psoriasis, or alopecia. Many become socially isolated or reclusive due to the pain, malodorous discharge, intimate sites of eruptions, inappropriate medical care due to incorrect diagnosis, the numerous lesions, long and continuous duration, and pelvic area involvement [5]. HS/AI patients, mainly women, lose an average of 2–7 days of work per year (or their jobs).

Associated diseases

HS/AI is associated with severe acne (acne conglobata), dissecting cellulitis of the scalp, and pilonidal cysts [22].

Chronic inflammation can cause SAPHO, a syndrome of synovitis, acne, pustulosis, hyperostosis, and osteitis [23].

Associations include ulcerative colitis (8%) [4] and Crohn disease (17%). Crohn disease can mimic the appearance of advanced, scarred HS/AI, and may form perianal and perirectal sinuses [4,24]. Pyoderma gangrenosum is more common than reports suggest. There are numerous other associations.

Complications (Table 4)

Anal and perianal fistulae and arthropathy can be associated. Lymphedema progressing to lymphangiectasia occurs. Repeated cellulitis is rare, septicemia is very rare, and osteomyelitis is exceptional. Massive genital edema, metabolic complications, with anemia, hypoproteinemia, and rarely amyloidosis may occur [24].

Table 4
Complications.

Fistulae into urethra, bladder, rectum (rare)
Arthropathy
Infections
Cellulitis
Lumbosacral epidural abscess
Sacral bacterial osteomyelitis
Lymphatic obstruction with lymphedema
Complications from chronic inflammatory disease
Anemia, hypoproteinemia, amyloidosis
Squamous cell carcinoma
Contractures and limb mobility limitations
Malaise, depression, suicide

Squamous cell carcinoma of the buttocks and perineum is late, uncommon, and predominant in men. Delayed diagnosis contributes to poor prognosis [25].

HS/AI patients suffer a 50% increase in the incidence of buccal and primary liver malignancy, possibly explained by lifestyles comforted by smoking and alcohol [26].

Thick plaques and rope-like scars bind down and limit limb movement. In the axillae and groin, perineal scarring may cause anal, urethral, and rectal strictures. Such patients are withdrawn and frequently depressed, and suicide is a risk.

Treatment

There is no single effective treatment or cure for HS/AI. The only permanent cure has been reported with wide surgery for very severe HS/AI (Hurley's III). Patients require metabolic, medical, and surgical strategies and lifelong gentle atraumatic care.

Care for HS/AI is generally experience based and lacks the evidence of blinded trials:

Gentle local hygiene. Wash with a mild non-soap cleansing bar. Where there is odor, an antiseptic cleanser with triclosan could be used. Wash with hands only, no washcloths or washrags. Avoid friction and irritation.

Reduce trauma, heat, humidity, sweating, and friction. Stop follicular trauma and maceration that could plug and rupture follicles. Wear loose ventilated clothing. Avoid tight or synthetic garments. Do not pinch or squeeze the lesions. Diet to ideal weight. Select tampons over sanitary pads. Stop smoking. Avoid *all* tobacco- and nicotine-replacement products [6].

Treatment varies by type of lesions, Hurley's stage, frequency of flares, and patient goals. See Table 5. Aim to prevent new lesions, and reduce the extent and progress of the disease activity to the least possible.

Medical management

Diet and metabolic management is essential. Medical treatments include antibiotics, hormonal management, and immunosuppressives (e.g., corticosteroids, cyclosporine, tumor necrosis factor alpha (TNFα) and interleukin (IL) inhibitors) [27]. Acitretin [28] and even isotretinoin in low dose are worth considering in early cases as gentle concurrent prophylactic therapy.

Dietary and metabolic management

Hormonal stimulation of the genetically susceptible FPSU population, by both dairy hormones and high glycemic load diets, occurs in HS/AI as it does in acne. All dairy products contain natural androgens and their precursors, numerous growth factors, and polypeptides that promote both hyperinsulinemia and higher levels of insulin-like growth factor-1 (IGF-1), all of which lead to a greater exposure of the FPSU to androgens [19]. The link to obesity is documented [17] and the use of

Table 5
General therapy.

Education and support
Improve environment:
Reduce heat, sweating, obesity, and friction in the area
Loose clothing, boxer-type underwear
Tampons, avoiding pads
Antiseptic wash − Triclosan cleanser
Antiandrogens whenever possible
Stop all dairy products
Low glycemic load diet
Stop smoking
Hurley Stage I
Clindamycin 1% lotion AM&PM
Short courses of antibiotics 7–10 days:
tetracyclines − doxycycline, minocycline
amoxicillin + clavulanic acid
clindamycin
Zinc gluconate
Intralesional triamcinolone
Mini-unroofing
Hurley Stage II
Medical therapy:
Clindamycin + rifampicin × 3 months, or dapsone
Intralesional triamcinolone
Maintenance − tetracyclines or dapsone
Zinc
Scarring/sinus tracts:
Surgical therapy:
Early mini-unroofing of new lesions
Wide unroofing of all active lesions - staged
Hurley Stage III
Medical therapy:
Anti-inflammatory
Antibiotics - clindamycin + rifampin
Steroids - prednisone, triamcinolone or cyclosporine
Biologics - TNFα inhibitors and others infliximab, adalimumab, etanercept, ustekinumab
Surgical therapy:
Aggressive total clearance using unroofing.
If above is inadequate, extensive plastic and reconstructive surgery with special nursing and wound care.

metformin in maximal tolerated doses to help drive weight loss can be part of a successful HS/AI strategy [29]. Bariatric surgery has led to therapeutic success [30]. Personal cases illustrating successful clearing with dietary control are being collected for publication.

Recognition of this link imposes an obligation on physicians to discuss comprehensive dietary management with HS/AI patients, and to offer assistance and advice with zero dairy intake, low glycemic load diets, and a commitment to weight loss. Professional and sustained nutritional counseling may be required. For further information, review and refer patients to www.hs-foundation.org, www.acnemilk.com, www.thepaleodiet.com, www.godairyfree.org, and www.glycemicindex.com.

Antibiotics

These are used extensively for HS/AI despite few studies on efficacy [31]. They treat the inflammatory epiphenomena of HS, not the cause. Used topically and systemically as anti-inflammatories, antibiotics may also decrease odor and reduce pain. Topical clindamycin 1% solution twice a day and oral antibiotics (doxycycline, minocycline, erythromycin, amoxicillin plus clavulanic acid, rifampicin, cephalosporins, and others) have been used, as has dapsone [32].

Antiandrogens

Cyproterone acetate (CypA) combined with ethinyl estradiol 50 μg for 6 months cleared seven out of 24 for 19 months [33]. CypA is not available in the United States.

Finasteride 5–10 mg/d, usually used for prostate cancer, has been successfully used in HS/AI [34]. Pediatric cases have responded well [14]. Dutasteride, also "off label," has helped clear both males and females in anecdotal personal cases. Both must be used with caution, as they are teratogenic. If oral contraceptives are considered, those containing ethinyl estradiol and drospirenone are preferred, combined with the antiandrogen spironolactone 50–100 mg when possible [29,35].

Immunosuppressives

Patients with HS/AI have significant inflammation and heightened immune responses [15]. The immune response, whether contributing to the etiology or reacting to subcutaneous material, is modified by immunosuppressants. They control but rarely clear the disorder [27,36]; therefore, they are best considered adjuncts to dietary and metabolic management, other medications, and surgery.

Corticosteroids have been used successfully intralesionally and systemically, mainly for symptomatic care [37]. High doses of systemic steroids, rapidly tapered, can be very effective in aborting an acute HS/AI lesion, quickly reducing pain and inflammation. Intralesional steroids (a small amount of triamcinolone acetonide 5–10 mg/mL) injected into an acute early lesion can sometimes effect rapid resolution. Cyclosporine (4–5 mg/kg/day) has been reported to help in a few cases [38]. Methotrexate orally has been used unsuccessfully [39].

Retinoids (acitretin and isotretinoin)

Retinoids are teratogenic but in very low doses can be effective in reducing new ductal occlusion. All 12 patients with recalcitrant Hurley's stage II or III HS/AI treated with acitretin (mean dose 0.6 mg/kg daily) for 9–12 months with or without topical therapy improved. Nine achieved remissions for 6–45 months after the cessation of therapy [28]. Isotretinoin in low dose, although controversial, has been useful for long-term prophylaxis in a few personal cases, but can cause flaring in usual doses. In one study of 68 cases, 23.5% completely cleared and 11 maintained improvement in follow-up, but 29 did not finish the study due to the lack of effects and/or side effects or both [40].

Biologics

Treatment with TNFα inhibitors and ustekinumab is effective in reducing inflammation in Hurley's grades II and III. Some patients with HS/AI treated with TNFα for 1 year achieved average recurrence-free intervals of 9.5 months for etanercept and 21.5 months for adalimumab [27]. Infliximab reduces pain intensity and disease severity and improves the quality of life. Relapses are common with all, and costs are high [36,41].

Compared to infliximab, adalimumab 40 mg every other week appeared to be less impressive and large trials have yielded very modest results. A randomized trial in which 154 adults with stage I–III HS/AI were treated with loading and increased doses of adalimumab showed that 18% of weekly adalimumab recipients versus 4% of placebo recipients achieved a clinical response [42].

Ustekinumab, an interleukin (IL)-12/23 inhibitor given via subcutaneous injection, has been reported in a few patients with moderate to severe refractory HS/AI to provide a varied response [43].

Biologics decrease swelling, inflammation, and discharge preoperatively, simplifying unroofing and excisional surgery, but affect neither the epithelialized sinus tracts nor the invasive proliferative gelatinous mass that is so resistant to therapy. Biologics are not a cure; improvement is rarely permanent.

The risk–benefit ratio of these drugs is undetermined; their role as the purported "ultimate alternative" needs definition. Significant side effects have been reported, including resistant vulvovaginitis. Efficacy, cost effectiveness, and safety studies in head-to-head comparisons to other HS/AI treatments are needed.

Miscellaneous and experimental therapies

Metformin

Metformin is reported to be useful [29,44]. It improves the sensitivity of peripheral cells to insulin, enhances the passage of glucose into individual cells, and lowers plasma glucose levels, reducing the level of circulating insulin. This decreases the sensitization of the androgen receptor [45]. The reactive hyperinsulinemia induced by drinking milk is thus attenuated. Metformin is an important part of the metabolic control program, an essential part of lifelong HS/AI management.

Zinc

Zinc is both anti-inflammatory and antiandrogenic, inhibiting both isoenzymes of 5α-reductase [46]. Zinc gluconate 90 mg/day yielded eight complete and 14 partial remissions in 22 patients [46].

Photodynamic therapy

5-aminolevulinic acid (5-ALA) has been used with exposure to various wavelengths of laser, visible light, and intense pulsed light. Results range from 0% to 100% improvement. No cures are reported. Recently, laser light has been delivered by fiber-optic probe intraluminally into sinuses irrigated with photosensitizer in solution. The preliminary results are positive [47].

Botulinum toxin

There is insufficient evidence to recommend this.

X-radiation treatment

X-radiation was thought to be helpful for early lesions but is not used now.

Cryosurgery

Repeated insufflation of liquid nitrogen into sinus cavities is reported to resolve chronic lesions [48].

Surgical management

For decades, the standard surgical management of HS/AI has consisted of wide excision. The margins are estimated preoperatively; width and depth vary case by case. Primary closure, flaps, grafts, or healing by secondary intention follows. This is usually limited to Hurley's Stage III disease where HS/AI is well beyond the reach of successful medical management [49] and will not be discussed here.

Unroofing

Unroofing is simple surgery, an old technique [50] that has been ignored for years. Recently revived [51,52], it deserves wide use. It is practical for lesions from the early hot nodules of Stage I to the

advancing, branching lesions of Hurley's Stage III. Removing early lesions and taking the tops off the deep epithelialized subcutaneous sinus tracts of HS/AI is invaluable. It requires nothing more than sturdy scissors, blades held parallel to the skin surface. Alternatively, laser has been used [53]. Unroofing is far more effective than prolonged antibiotics and anti-inflammatory therapy.

Unroofing is not technically difficult, can be performed in the office setting under local anesthesia, and therefore is easily adapted to the emergency room.

This is the technique that we recommend replace "I&D" of fluctuant masses and other manifestations of HS/AI. Every opportunity to perform I&D should be converted into an opportunity to unroof the lesion. It provides superior drainage and pain control, eliminates the risk of inadequate "wound toilet" that leaves behind the IPGM and fragments of the exploded FPSU. These are the sources of recurrences. I&D is a temporary "solution"; unroofing is almost always permanent. It requires very simple postoperative dressings and postoperative pain is remarkably easy to manage.

Lidocaine 1–2% anesthesia with epinephrine is used. Controlled volumes are injected peripherally, avoiding leakage through sinuses. Time for vasoconstriction reduces pain and blood loss.

A single inflamed follicular unit requires only urgent mini-unroofing (not I&D). A biopsy punch of appropriate diameter (5–8 mm) is centered over the involved FPSU and a twisting incision removes the central damaged material. This is then debrided with digital pressure, grattage with gauze wrapped around a cotton applicator, then ferric chloride hemostasis is applied with a cotton-tipped applicator (Fig. 2).

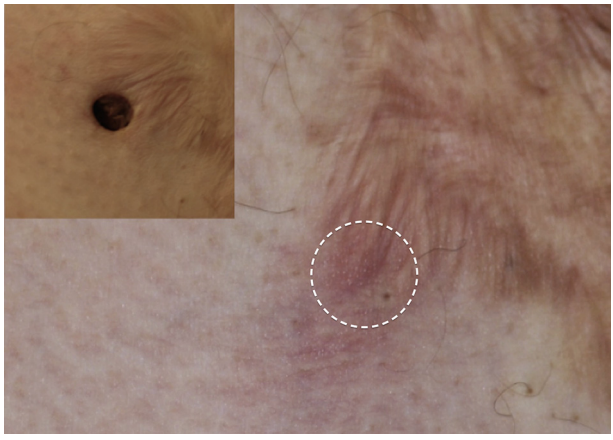

Fig. 2. Mini-unroofing. A 6-mm biopsy punch is used to excise a single inflamed axillary FPSU and a nearby open comedo. Inset is the excision site, with hemostasis using ferric chloride.

Fluctuant masses are best initially incised and drained to reduce pressure. The central linear incision is extended to the edge of the loose tissue over the fluctuant area and the incision is extended through 360° at the edge of the "roof," beveling the edges with scissors. The base of the wound is then scrubbed with coarse gauze. Curettage with a spoon or bone curette may be needed to remove the IPGM (Fig. 3). Excision of fat at the base of the wound is unnecessary and counterproductive. All depths and margins are explored digitally, visually, and with scissors tips. Any linear fibrous tissue is suspect as a possible sinus track and is best removed. Communicating sinuses once detected are unroofed. They can be surprisingly extensive and must be totally unroofed. Remove all tissue that is involved with active disease, devitalized or, if left behind, would interfere with healing. The wound base and small bleeders are dried and sealed with ferric chloride solution. Electrodesiccation or electrocautery are rarely needed. Scars are normally soft, contract to a much smaller area than that unroofed, and are quite acceptable to the patients (Fig. 4).

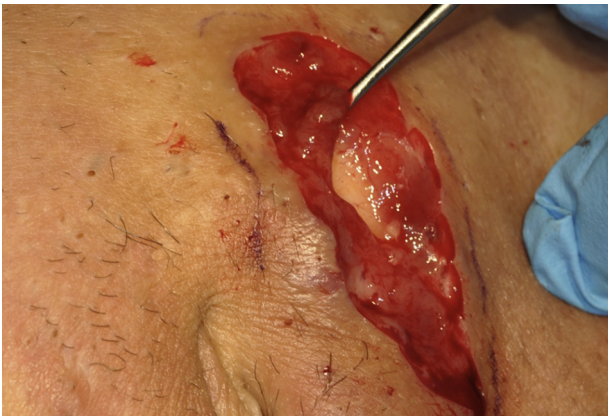

Fig. 3. Curetting the IPGM. The gelatinous mass varies in consistency from that of relatively clear vitreous humor to granulation tissue to the fibrinous debris encountered in cutaneous ulcers.

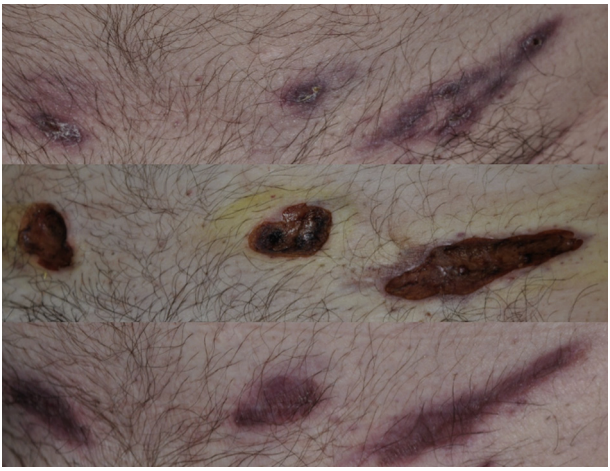

Fig. 4. Unroofing. Top illustrates several solitary and communicating lower abdominal sinus tracts. Middle is status immediately postoperative showing extent of unroofing required to follow and expose all connected sinus tracts. Bottom shows healing at 6 weeks with contraction, flat painless scars, no residual activity. The color fades over 6–12 months.

Postoperatively, the wound is dressed with a thick coat of simple petrolatum. Running water only, no antibacterial soaps and no washcloths are used. Thick layers of petrolatum on cotton or soft gauze are reapplied once or twice daily or as needed. Patients (and wound care staff) must avoid debriding the wound. Healing by secondary intention and epithelialization will proceed only if the fresh epidermis is allowed to cover the wound and is not debrided away. HS/AI is not an infection; the inflammation is caused by the material removed by this procedure, so antibiotics are rarely necessary and are best avoided to minimize the overgrowth of yeast and resistant bacteria.

Unroofing also eliminates the risk and costs of hospital or ambulatory surgical center care, laser, general anesthesia, graft donor sites, dehiscence, infection, the burying of residual inflammatory foci, postoperative antibiotics, time lost from work, and the need for travel to major centers [51]. When performed correctly, it stops forever the progression of the lesion treated.

In severely involved patients, several visits may be required to clear all areas. Patients learn to appreciate this. The chronic patients' tendency to hide from life gradually yields to an enthusiasm for final clearance.

Summary

This is an orphan disease that is ready for adoption, now that the causes are becoming understood and cost-effective therapies are being brought to the patient. This disease will not respond to "trying one thing after the other." Effective management requires that the following four areas must be addressed at the same time:

1. Hormonal Management Including Diet
2. Comedo control
3. Inflammation control
4. IPGM elimination

Importantly, this is *not* "step therapy" – these measures must be concurrent and parallel and likely lifelong. We must have all four wheels on the therapeutic wagon.

HS/AI patients (and their physicians, surgeons, and dieticians) need to understand this disease in order to develop realistic expectations and to work with each other for the best outcome. HS/AI is not contagious and not due to poor hygiene. Diet may prove more valuable than surgery. Hormone control is more valuable than antibiotics. Surgery should be undertaken as early as possible and need not be mutilating, expensive, and painful.

A number of unresolved questions (see Research Agenda) need answers before we fully control this disease.

HS/AI is not easy to manage, but is manageable, and the word "cure" is no longer out of reach.

Practice points

- Hidradenitis suppurativa is a chronic relapsing disorder of the defective folliculopilosebaceous units (FPSUs).
- FPSU is under the influence of endogenous reproductive hormones, exogenous hormones, androgens, and other dietary factors.
- Rupture and leakage of the FPSU causes an inflammatory reaction.
- Successful therapy is guided by the Hurley stage of disease.
- Multidisciplinary treatment requires patient comprehension and cooperation, aggressive hormonal and dietary modification, avoidance of the trauma that leads to rupture, active multimodal anti-inflammatory therapy and early unroofing and debridement of lesions.

Research agenda

- Solidify role of diet and metabolic control in prevention and therapy.
- Evaluate usefulness of medical therapies and how best to combine with surgery.
- Determine the most effective long-term modalities.
- Define the genetics of the disease.
- Investigate the relationship of HS/AI to Crohn disease.
- Ensure recognition, early diagnosis, and expedited access to trained physicians and surgeons.
- Evaluate and standardize guidelines for the use of biologics, their role, and cost effectiveness.

Conflict of interest statement

The authors of this paper have no financial interests or personal relationships that could have created a conflict of interest.

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