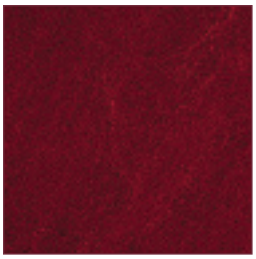

Surgical Management of Hidradenitis Suppurativa: A Narrative Review

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J Clin Aesthet Dermatol. 2022;15(1):35–41.

OBJECTIVE: Hidradenitis suppurativa (HS) is a debilitating, chronic, dermatological inflammatory skin disease that affects apocrine gland bearing skin in the axillae, groin, and inframammary regions. It is underdiagnosed and its pathogenesis incompletely understood. This paper provides a comprehensive review of the existing literature on the surgical management of HS, focusing upon outcomes of definitive surgery. **METHODS:** A literature search was conducted according to PRISMA guidelines. PubMed and EMBASE databases were searched for original studies pertaining to the surgical management of HS published from January 1970 to July 2020. A total of 33 papers were included for analysis. **RESULTS:** Management options include risk factor modification, pharmacological agents, and surgical intervention. Many surgical management techniques exist, including incision and drainage, CO_2 laser therapy, deroofing, wide local excision, and reconstructive surgery. Incision and drainage is commonly utilized for symptom relief of sepsis. While data on curative surgical management are lacking, studies on surgical approaches have shown favorable outcomes in highly selected cases.Wide excision with flap reconstruction results in high patient satisfaction rates, good cosmesis, and reduced disease recurrence. **LIMITATIONS:** A small number of suitable papers met our specific focus and inclusion and exclusion criteria. Novel techniques described in case studies were missed. Additionally, this study examined HS management as a whole, but region-specific management was not reviewed closely. **CONCLUSION:** The success of surgical management is dependent on multiple factors. Thus far, the precise role of surgery in elective treatment of refractory HS requires further analysis and reporting of outcomes. **KEY WORDS**: Hidradenitis suppurativa, surgery, reconstruction

Hidradenitis suppurativa (HS) is a recurrent chronic inflammatory disease that primarily affects the apocrine skin glands.[1] HS is debilitating to those affected and is underdiagnosed.[2] Its prevalence has been found to be between 0.1 to 2 percent[2] with prevalence three times higher in women than men.[3] Onset of the disease generally occurs after puberty, primarily affecting adults in the second and third decades of life.[1] Patients of African descent and low socioeconomic status have an increased incidence of HS.[4] While the etiology of HS is not completely understood, genetic susceptibility, immune pathway dysregulation, and hormonal etiology are implicated.[2] There is also a strong association between HS and both smoking and obesity, with 63 percent of patients being smokers and 76 percent having obesity in some series.[1] Furthermore, acne and hirsuitism are significant associations.[1]

HS occurs as a result of the destruction of hair follicles, leading to a severe acute inflammatory response and sebaceous gland destruction. Subsequently, the patient develops painful abscesses, sinus tracts, fibrosis, hypertrophic scars, and nodules.[3] Common areas affected include the inguinal region, anogenital area, and breast areola, as well as the inframammary, axillae, and periumbilical regions. In advanced cases, deep tracts may be formed as a result of sinus dissection into fascia and musculature.[5]

Patients with HS suffer a variety of symptoms, both local and systemic.[6] Local symptoms include burning sensation of the skin, pain, pruritis, malodor and hyperhidrosis.[5] Anemia, lymphedema, and musculoskeletal conditions are also associated with this disease.[5] The debilitating nature of HS and the financial burden of treatment places patients at a higher risk of developing psychiatric disorders such as depression and anxiety.[5] HS is significantly more disabling than other chronic dermatological diseases.[6]

The Hurley staging[5] is the most widely used system for classification and staging of HS. Hurley categorizes patients based on severity into three categories, detailed in Table 1.[2,5] It was designed to guide treatment selection for patients with HS, but may not be as effective in monitoring progress with treatment.[7] The Modified Sartorius Score is a antoher tool used to assess disease severity. It is often considered time consuming and, as multiple versions of the tool exist, confusion amongs users has been reported.[8,9] The Dermatology Life Quality Index (DLQI)[6] is another useful

FUNDING: No funding was provided for this article.
DISCLOSURES: The author reports no conflicts of interest relevant to the content of this article.
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TABLE 1. Hurley staging system

HURLEY STAGE	DESCRIPTION
1	Presence of abscess With or without sinus tracts
2	Recurrent abscess with sinus tracts and scars and widespread lesions
3	Diffuse or near diffuse involvement or multiple tracts and abscesses

Adapted from Kohorst et al[6]

tool in the evaluation of patients.[2] DLQI is a questionnaire that quantifies the effect of skin conditions on the daily life of a patient.[6] It is particularly helpful, as pain is a crucial element in determining management options.[2]

HS is a very challenging disease for patients and clinicians. Existing management options are aimed towards symptom and lifestyle management rather than cure. Management involves risk factor modification, medical therapy, and surgical strategies.[10,11] Medical management relies on antimicrobial therapy, lifestyle modification and immunomodulators such as anti-tumor necrosis factor (TNF)-alpha.[3]

Objectives. In this study, we examine the current literature pertaining to surgical management of HS and the reported outcomes of surgical interventions to provide an overview of the contemporary surgical management of hidradenitis suppurativa.

METHODS

A review was conducted in February 2020 using a systematic approach, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[11] Articles published from January 1970 to the present were searched in the MEDLINE (PubMed) and EMBASE databases. The last search was performed in July 2020. An initial search was performed using the search term "hidradenitis suppurativa". This returned 2,978 results on PubMed and 4,008 results on EMBASE. The search results were further refined using the terms "hidradenitis suppurativa + surgery" followed by "hidradenitis suppurativa + surgery + management". The final search terms were "hidradenitis suppurativa + surgical management". The same search strategy was used on both databases. Following this, inclusion and exclusion criteria were applied and duplicates removed. Articles reporting outcomes for both adult and pediatric patients undergoing surgical management of HS were included. Review articles, case studies, correspondences, articles without full paper access, and articles not available in English were excluded from analysis.

The primary and secondary outcome of this narrative review were defined prior to selection of papers. The primary outcome was defined as tissue healing. The secondary outcome was recurrence rate after surgical treatment.

Due to the heterogeneity in populations, interventions and outcome measures in the included studies, a meta-analysis was not performed. Instead, the relevant findings are presented as a narrative review.

RESULTS

A total of 465 results were returned using the finalized search terms. Duplicates were then removed, leaving a total of 382 papers. Following this, inclusion and exclusion criteria were applied to each of the database searches, resulting in 89 papers from PubMed and 91 papers from EMBASE. Following screening of these papers for relevance and accessibility by review of abstracts, 33 articles were finally selected for inclusion in this analysis. All 33 articles were available in full and in the English language.

Additional key information on lifestyle factors affecting HS and some pharmacological therapy was included and presented in the results section prior to surgical management results.

Lifestyle factors affecting HS, smoking, and smoking cessation. Various studies have demonstrated a strong association between smoking and HS as a risk factor for developing severe disease.[13] Literature shows that 70-90 percent of patients with HS are current or former smokers.[13] While the exact pathophysiology of the effect of smoking requires further investigation, immune dysregulation by its by-products are believed to play an important role. Some studies suggest that nicotine overstimulates sweat gland, leading to blockage of the glandular ducts[14] and a subsequent inflammatory reaction. Additionally, nicotine modifies sweat gland activity, producing proinflammatory cytokines, such as interleukin (IL)-8 and TNF-alpha,[15] which causes abnormal glandular secretion seen in HS.[14,15] Nicotine acetylcholine receptors suppress the NOTCH signaling pathway, a key cell pathway that is involved in cell-to-cell communication, gene regulation, cell regulation, and cell differentiation.[15] Dysregulation of this pathway is associated with multiple disease states, including HS.[15] Moreover, nicotine is associated with *Staphylococcus* aureus growth, commonly found in severe HS lesions.[16]

A case-control study that reviewed demographic and anthropometric factors in relation to HS showed a 14-fold increase in the incidence of HS in smokers.[17] A retrospective study looked at the diagnosis of HS in four million tobacco smokers over the course of three years. This study demonstrated tobacco smokers had an increased risk of HS by 90 percent compared to non-smokers.[13]

Smoking cessation does appear to have an impact on disease progression and relapse. Walter et al[16] studied the difference in relapse of HS in smokers following surgical management. Of their patient cohort, 89 percent had some smoking history. Relapse in active smokers was 47.8 percent, 45 percent in ex-smokers, and 40 percent in non-smokers.[16] Compared to current smokers, the potential for disease improvement among non-smokers and former smokers in response the first-line therapy, including antibiotics and corticosteroids, was 2.6 times higher.[18]

The demonstrated relationship between smokers and HS prevalence is important in the long-term management of the HS. Smoking cessation is a modifiable risk factor that patients can be counseled on. Smoking cessation may help prevent the development of the disease in high-risk individuals, might reduce disease severity in those who have already been diagnosed, improve treatment response, and reduce the risk of refractory disease. As shown by Walter et al[16], ex-smokers experienced reduced relapse of disease, emphasizing the importance of counseling smokers on cessation.[16]

Body Mass Index and weight loss. HS has a strong association with Body Mass Index (BMI). Over 75 percent of HS patients with HS have overweight or obesity (BMI 25–30 defined

as overweight, BMI>30 defined as obese).[1] High BMI has been linked with a worse modified Sartorius score of severity of HS.[19] The Modified Sartorius score is a partially validated alternative tool for assessing HS severity.[19]

Reduction in weight is encouraged in these patients as a means of decreasing disease severity. Choi et al[20] followed patients one year after losing weight via dietary modification, demonstrating significant reductions in abdominal lesion induration but no noticeable changes in perianal lesions.[20] Additionally, it was found that patients who have had surgical interventions for weight loss might experience worsening of HS symptoms due to postoperative malnutrition.[20] Kroman et al[21] examined a total of 383 patients with HS who lost weight. Of this cohort, 49 percent of patients exhibited total resolution of lesions, 20 percent had improved symptoms, 20 percent remained stable and 11 percent saw worsening of these symptoms.[20,21] A recent systematic review examining weight loss in patients with HS demonstrated resolution of disease states in both diet-induced and surgical weight loss patients.[21]

While these results are promising, it is crucial to consider other factors that might have contributed to these results. Also, research in this area is currently limited. Further prospective randomized control trials are necessary to determine the effect of weight loss measures alone on HS severity and control.

Pharmacological treatments. Medical therapy is used as first-line treatment of HS. Current medical therapies include topical and systemic therapies in the form of antibiotics, steroids, and biological agents. There is a high rate of refractory disease and significant side effect rate associated with medical therapies.[23] Topical clindamycin and systemic tetracycline are considered first line for HS treatment, with oral antibiotics being prescribed in cases where topical antibiotics are not effective or the disease state is more severe. Efficacy of other non-biological agents is currently limited to level four evidence and expert opinion.[19] A recent study found a combination therapy of oral antibiotics, followed by hyperbaric oxygen therapy had significantly better results than oral antibiotics alone.[7] In addition to antibiotics, intralesional injections of glucocorticoids has been shown to reduce severity of HS, and anti-androgens has shown reductions in discharge, abscesses, and nodules.[24]

Immunomodulators. TNF alpha is an important cytokine involved in the inflammatory response.[25] It is produced by a variety of cells, including macrophages, neutrophils, mast cells, natural killer cells, and CD4+ lymphocytes.[25,26] TNF alpha acts by stimulating cell inflammatory mediators and promoting the expression of cells involved in the inflammatory process and acute phase reactions.[25] TNF alpha levels have been shown to be increased in patients with HS, although elevated serum levels are not prognostic.[26]

Adalimumab is a monoclonal antibody that acts against TNF alpha, blocking its biological activity. It lowers levels of proinflammatory cytokines, such as interleukin-6, IL-8 and IL-1B, which regulates the immune response.[25] It is also associated with decreased levels of inflammatory leukocytes, monocytes, dendritic cells, and macrophages.[25] For the management of HS, adalimumab is administered via subcutaneous injection at an initial dose of 160mg followed by an 80mg dose after 14 days and subsequently maintained with a 40mg weekly dose.[27] At present, adalimumab is the only biologic therapy that is approved by the United States Food and Drug Administration (FDA) for the treatment of HS due to its demonstrated success in the management of moderate to severe disease.[28]

Two significant Phase III trials of adalimumab and HS have been reported by Kimball et al.[29] Both trials, PIONEER I and PIONEER II, were conducted to assess the safety and efficacy of adalimumab in patients with HS compared to a placebo.[29] In PIONEER I, 41.8 percent of patients showed improvements in clinical response with adalimumab compared to 26 percent in the placebo I.[29] PIONEER II had a 58.9 percent clinical response rate to therapy in the treatment group versus 27.6 percent in the placebo group. Furthermore, lesion count and modified Sartorius score were also reduced in PIONEER II in the treatment group. Less than five percent of patients experienced adverse events.[29]

Anti-TNF treatments, however, do pose a risk of increased soft tissue and skin infections, which can lead to sepsis.[30] HS also presents a risk of supra-imposed infection on active lesions, which can progress to sepsis.[30] Although the adverse event rate of adalimumab is low, Blanco et al[30] recommend microbiological samples for all active, draining lesions prior to commencement of anti-TNF treatments.[30] Treatment with antibiotics prior to biologic therapy might be beneficial in reducing infection rates.

Surgical management. Current surgical management of HS is often determined on a case by case basis, with conflicting approaches reported in the literature regarding the optimal surgical technique depending on the anatomical location.[31] The choice of surgical management is determined by the chronicity of the disease, the site and extent of the disease, the patient's comorbidities and the previous treatments utilized with the patient.[7]

Definitive surgery for HS should ideally be performed when the active inflammatory process is at a minimum and the disease is in remission.[7] Hurely Stage I or II disease results in shorter healing time to wound closure than Hurley Stage III disease. Lesion size is also directly proportional to healing time.[8] Choice of surgical procedure should take into consideration disease stage and size, recurrence rate, extent of excision, and potential morbidity of the intervention.[2]

Incision and drainage.The procedure of incision and drainage is utilized in the acute phase, primarily, to relieve the symptoms of a severe fluctuant abscess and prevent propagation of sepsis.[7] Following administration of local anesthesia to the area, an incision is made to drain the abscess cavity.[7] The cavity is then packed with gauze and changed daily.[7,32] While demonstrated to be extremely helpful with the immediate pain relief and discomfort relief, incision and drainage of HS is associated with a very high recurrence rate, reaching nearly 100 percent.[2] It enables acute relief and reduction of inflammatory tissue prior to a definitive procedure.[32] This search has identified a gap in the literature with regard to an evidence base for incision and drainage in HS.

Deroofing. Deroofing and curettage is a minimally invasive, tissue sparing procedure that is simple to do, cost effective, and minimizes the risk of cosmetically poor scars.[7] It preserves the floor of a sinus tract to allow for rapid re-epithelialization of the wound by hair follicles and sweat glands.[32] Wounds are usually left open for healing by secondary intention following a deroofing procedure[7]. It is used for treatment of Hurley Stage I and Stage II sinus tracts and nodules that are persistent[7] and is generally preferred over incision and drainage for smaller lesions.[2]

The procedure is carried out under regional or general anesthetic. Using an aseptic technique,

sinus tract openings are located and identified with a blunt instrument.[32] The walls and roof of the tract are identified, laid open and curetted, ensuring the floor of the tract is kept intact. The contents of the floor of the tract is curetted and the wound is allowed to heal.[32]

Van der Zee et al[10] examined 44 consecutive patients, who in total underwent 88 lesion deroofing procedures, treated by a single clinician over a five-year period.[10] Seventeen percent of the treated lesions recurred within a median of 4.6 months and 73 percent of lesions did not recur at median 34-month follow up.[10] High patient satisfaction rates were reported in 90 percent of patients stating that they would recommend the deroofing procedure to other patients.[10]

Wide local excision. Wide local excision (WLE) is sometimes regarded as the only curative surgical procedure for advanced HS, Hurley Stage III or greater.[33] This entails excision of all tissue, inclusive of skin, subcutaneous fat, nodules, and sinuses. Excision is performed down to the deep fascia and a clearance margin of 1 to 2cm is achieved.[11] Wounds can either be closed primarily, left to heal by secondary intention (SIH), or closed with a flap or skin graft.[11] A meta-analysis carried out in 2015 reported a 13-percent recurrence rate in patients who underwent WLE, 22-percent recurrence after local excision and 27-percent recurrence after deroofing, thus favoring WLE.[34] The same study also showed a higher recurrence rate after WLE with primary closure (15%) than with flaps (8%) and grafts (6%)[11] Complications of WLE include wound dehiscence, infection, and bleeding. Rompel et al[36] reported a 3.7-percent wound infection rate and 17.8-percent complication rate in 106 patients treated with WLE.[35,36] In two studies that compared incision and drainage, limited excision and WLE demonstrated that recurrence rates were lowest in the WLE group.[35]

Shavit et al 2020 performed 134 WLEs on 66 patients with HS, comparing the outcomes of primary closure with flaps and secondary intention healing (SIH) post operatively. Local recurrence for both primary closure and SIH was 18 percent, with local recurrence defined as recurrence within 0.5cm of the original site. Notably, all patients in this study had more conservative excisions, to healthy adipose tissue, but not down to the deep fascia. Shavit et al 2020 suggests that HS is a pilosebaceous unit disease rather than a disease of sweat glands and therefore there is no requirement for removal of apocrine gland projections.[33] Danby and colleagues also recommend that excisions should continue until healthy subcutaneous tissue is visualized.[37] Excision of excessive tissue leads to tissue damage and promotion of collagen synthesis in the dermis, leading to increased scarring thus emphasizing the importance of limiting excision to unhealthy tissue.[7]

SIH has shown positive results post WLE in HS, with good cosmetic and functional results within 2-3 months of surgery.[11] Benefits include small scars, no flap or graft loss and adequate movement[39], however, the delayed closure may lead to infection, joint contractures, scarring and reduced function.[2] Low recurrence rates with SIH are thought to be due to formation of new granulation tissue which does not contain apocrine glands.[40] SIH is particularly effective in midline wounds or in regions with natural body creases, whereas larger flat surfaces heal slowly after excision by epithelialization and are more likely to require skin grafts.[41]

Posch et al 2017's retrospective study of HS patients with Hurley stage III axillary and inguinogenital disease also indicated that recurrence following WLE is rare.[42] Following excision only 18.9 percent of patients (n=74) had postoperative relapse in the same anatomical area as their initial disease location, the majority being in the inguinogenital area. Only one patient with axillary disease had recurrence post excision.[42] Additionally, this study examined patient satisfaction before and after WLE using the DLQI and cosmetic satisfaction. Preoperatively, the average DLQI score was 27.89, a high score indicating an extremely high impact of disease on the patient's life.[42] The postoperative DLQI score average was 5.[31] Seventy percent of patients were satisfied with the cosmetic result of their procedure. This significant improvement demonstrates the positive effects of WLE on severe HS.[42]

CO_2 laser. A more recent approach to surgical management of HS is the use of carbon dioxide (CO_2) laser excision.[35] The first reports of CO_2 laser excision are from 1987 in the United Kingdom.[43] and 1996 in the United States.[44] Healing is either by SIH or primary closure.[44] Laser is a favored technique due to the ability to easily manage bleeding, the quick speed of the process, and reduced pain severity compared traditional surgery.[37] The majority of procedures can also be performed under local anaesthesia, eliminating the risks associated with general anaesthesia.[45] With vaporization, the surgeon passes the laser over the affected area repeatedly until the affected tissue is ablated and a smooth defect is formed.[44] This technique also allows for early visualization of abscessed and abnormal tissue, ensuring complete clearance of the affected area.[44] This method is effective in treating Hurley Stage II patients, is quick, and reports high patient satisfaction.[2] Danby et al[37], however, reported a high recurrence rate of 29 percent in these patients.[47]

Laser can also be used to perform deroofing or local excision of deep lesions, particularly in areas with scarring, fibrosis, sinus tracts, or areas that have previously been treated.[37] The laser is focused to a narrow diameter and used to excise the base, roof, and margins of the lesions; subsequently, the cavities are explored with a metal probe and contents are removed.[37,45] The laser is then used in a wider, unfocused setting to create a smooth base for subsequent SIH.[37]

Recent studies have shown variance in results based on CO_2 laser strengths. Use of a micro-fractionated 10600 laser enhances skin elasticity, scarring, and erythema, whereas the 1450 diode laser has been shown to reduce sweating and might be helpful in skin creases.[24] The literature indicates that SIH after laser excision improves complication rates, particularly in flat lesions or scars and early stage disease.[24]

Hazen and Hazen[45] performed 154 CO_2 laser treatment sessions on 61 patients with HS. An average of 2.5 treatment sessions per patient was recorded, with increased requirements in patients with obesity (average 7.1 treatments) and African-American patients (average 3.8 treatments).[45] Healing reported in this study was by secondary intention, with the authors reporting an average of 8.8 weeks post-procedure for re-epithelialization to occur.[45] Postoperative complications occurred in 18 percent of procedures, the primary complication being hypertrophic granulation tissue formation.[45] This was successfully treated with silver nitrate in all cases. There were no recurrences reported in the average 4.1 year follow-up period.[45] While this study provides encouraging outcomes of CO_2 laser treatment, data on long-term outcomes following laser excision is minimal.

Skin flaps and grafts. Flaps and grafts are a

common alternative to SIH after WLE in patients with HS. Grafts generally refer to split thickness skin grafts (STSG) in which the epidermis and only part of the dermis are used. Alternatively, flaps involve resection of full thickness tissue, including its blood supply, from a donor site, and moving it to the recipient site. A study of perianal, perineal, and gluteal HS suggested that healing time with flap reconstruction (n=2) was significantly less than with grafting (n=2) (2 weeks vs 8 weeks respectively).[40]

Grafting, although versatile and effective, has reported complications of poor healing due to lack of intact blood supply, higher rate of contractures, and aesthetic differences with surrounding skin.[39] Complications with later onset of ulceration and dehiscence are also reported.[46] Ge et al[4] suggest the use of negative pressure wound therapy as an adjunct to grafting to reduce edema, donor site morbidity by wound contraction, and accelerate granulation tissue.[4] Their study demonstrated no evidence of postoperative wound infection or dehiscence after negative pressure wound therapy plus grafting was used.[4]

Flaps might be preferable in regions where reduced functionality after resection might be a concern. Flaps demonstrate greater effect when introduced at an early stage of HS.[24] Flaps provide thicker coverage with soft tissue, reducing the risk of contractures (e.g. across joint creases) and a more natural cosmetic appearance. They might, however, require thinning in a subsequent procedure[2] and are prone to necrosis and hemorrhaging.[39] It is imperative that prior to flap reconstruction, margins at the excision site are sufficiently cleared to reduce recurrence rate.[49]

A variety of flap reconstruction techniques have been explored for HS management. Virág et al studied the efficacy of key stone perforator island flaps (KPIF) in 22 patients with HS suggesting that the elliptical shape reduces donor site defect size, lax tissue provides adequate movement, and the technique can be adapted to any defect size.[46] Additionally, physiotherapy can be started early postoperatively, operative time is shorter than with other flap or grafting techniques, monitoring is minimal, reducing rehabilitation duration and avoid long-term immobilization.[46] The patients in this study experienced no major postoperative complications such as dehiscence or necrosis. The authors attributed this to the shape of the flap and the low tension on the wound.[46] While the study results are promising, the small sample size and lack of supplementary supportive evidence must be taken into account when applying this technique.

Wormald and Balzano[23] compared outcomes of 27 patients with Hurley Stage II axillary HS in a four-year period who received either reconstruction by STSG or a thoracodorsal artery flap (TDAP).[23] The TDAP group required longer operative duration; however, their mean hospital stay and recovery to their pre-operative baseline was significantly shorter than the STSG group. The TDAP group experienced fewer complications and required shorter follow up.[23] Of the 12 patients in the STSG group, five patients had delayed wound healing due to graft failure, one had delayed healing at the donor site, and three patients required revision procedures for restricted shoulder movement. In the TDAP, two patients underwent revision procedures, one for scar revision and one for debulking. The DLQI indicated that patients in the TDAP group also showed greater improvement in quality of life postoperatively.[23] Wormald and Balzano[23] suggest that STSG should be reserved for Hurley Stage I–II HS as severe extensive disease poses a higher risk of grafting complications.[23] The TDAP reconstruction results were positive and promising, but similar to the KPIF study, supplementary supportive data is minimal and the study sample size was small.

HS treatment with the TDAP flap has not been studied in depth, but the TDAP flap does have potential advantages, particularly for axillary HS. The procedural duration of a TDAP flap is relatively short [23], donor site scarring and complications are limited, and the skin texture and color are extremely similar to axillary skin.[47] The flap allows for maintenance of the axillary shape and reduced risk of contractures.[47]

Axillary HS commonly causes pain and reduced function of the shoulder on the affected side.[48] One study reported quality of shoulder function following TDAP axillary flap in their 20-patient cohort using the Constant-Murley Score. Compared to postoperative scoring, the post-operative Constant-Murley scores reflected significant improvement in all areas of shoulder function (range of motion, pain, activities of daily living and abduction strength). Improved post-operative DLQI scores were also reported with an average drop of 8.35 in Hurely Stage II patients and 18.59 in Hurely Stage III patients.[48] This study did report low complication rates overall, but patients did experience some of the more rare complications, which illustrate potential risks of this procedure.[48] Some of these complications included diminished flap sensation, initial postoperative pain, paresthesia, flap lymphoedema, seroma formation, and hypertrophic scarring.[48] While the potential advantages are suggestive of positive success rates with the TDAP flap, further evidence of the procedure and its outcomes and review of a larger sample size is required. Positive responses from patients on improved quality of life following surgery are promising.[49,50]

Novel surgical techniques. Innovative surgical techniques for HS management are constantly being explored. The following two techniques have been described in case studies, which were exclusion criteria for this review, and therefore not included as valid papers for this study, however their potential is promising.

Skin-tissue sparing excision with electrosurgical peeling (STEEP) is a novel technique that has been described as a combination of WLE and deroofing and aims to reduce healthy skin excision in HS. This procedure is performed under general anesthesia.[51] Initial palpation of the area is performed by the operating surgeon to identify extent of the disease. Visible sinuses and tracts are subsequently probed and excised using an electrosurgical wire loop.[54] Lesions are identified again using palpation and excised to the deeper dermal layers. Sinus tracts base epithelialized layers and subcutaneous tissue are kept intact allowing for a smaller, more superficial defect with reduced healing time and complications.[51]

Setons are currently commonly used for the closure of perianal fistulas. Lajevardi and Abeysinghe[52] applied the principal of seton use in perianal fistulas to HS fistulas, which can occur in other regions of the body.[52] In one patient, axillary abscesses were identified, drained and irrigated. Setons were then placed in the fistulous tracts and the patient was discharged with significant improvements in inflammation. All setons were removed by the sixth postoperative week, the patient did not experience any post-operative recurrence after six months.[52]

Limitations. This study is limited in the relatively small number of suitable papers that met the specific focus and inclusion and exclusion criteria. HS is an underdiagnosed and

under researched disease. Limiting our study selection to English-language studies might have limited the quantity of data for analysis. While the broad search period enabled an overview of treatments historically, it does not facilitate a more updated reflection of treatment options, with improvements in much of the previously published data. Novel, emerging surgical methods or combination methods have also been missed due to the exclusion of case reports. Furthermore, this paper looked at surgical management on a broad scale, but literature suggests that optimal surgical management varies based on disease location. A redefined focus on management for individual regions might be helpful in determining surgical cure. This review has identified a gap in the literature on specific surgical management for HS by region .

CONCLUSION

Hidradenitis suppurativa is a complex disease with a variety of management options. Definitive treatment might require multiple interventions and outcomes appear to differ between patients. Evidence supporting a surgical solution for HS is lacking, and current literature indicates that a surgical approach is varied with unpredictable outcomes. HS often masquerades as other disease processes and diagnosis is often late. A step-up approach with lifestyle modification and pharmacological approaches in the initial phases is optimal. Incision and drainage has no role in curing HS, but expedites symptom improvement. Flap reconstruction after WLE for HS offers the best option to achieve disease control but must be individualized to the disease location such that the morbidity of the intervention does not exceed the morbidity of the disease. Further investigation of the most effective surgical technique, exploration of emerging techniques, and long term follow-up is necessary to optimize the multidisciplinary management of HS.

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