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Cost comparison of split thickness skin grafting with and without bilayer dermal regenerative templates for bilateral axillary hidradenitis suppurativa: A retrospective comparison study

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ABSTRACT

Objective: Overview of our staged procedure for excision and placement of split thickness skin graft for bilateral axillary hidradenitis. Compare cost, outcomes, and timing of our staged excision to those utilizing bilayer dermal regenerative templates prior to placement of skin graft for axillary hidradenitis.
Methods: An IRB approved retrospective case analysis was performed on patients that underwent bilateral axillary hidradenitis skin excision with eventual placement of split thickness skin grafting utilizing the current LSUHSC/University Health hidradenitis surgical treatment protocol. Utilizing ICD-9 codes (705.83) and CPT codes (11041, 11042, 11451, 11600, 11601, 11602, 11603, 11604) we reviewed cases performed at our institution from 1/1/08 to 2/24/14 and we selected 7 patients based on bilateral axillary involvement (alone) and >1 year history of active disease. Patients were excluded if resection of tissue encompassed regions outside of the immediately adjacent axillary regions.
Results: A total of 7 patients were selected for analysis. Clinical course, cost, and surgical techniques were assessed. Six out of seven patients required admission throughout their treatment course secondary to lack of funding, making home use of negative pressure wound therapy devices not possible. Our patients stayed an average of 10 days with a mean hospital charge of $35,178 and a mean hospital provider charge of $10,019. No recurrence was demonstrated. All patients attained full range of motion, post grafting. No patients required return to operating room for failed graft.
Conclusion: Bilateral axillary hidradenitis is a chronic, suppurative, and scarring disease process that is most effectively treated by complete excision of all hair-bearing tissues. Split thickness skin grafting without use of bilayer dermal regenerative templates yielded definitive results with acceptable cosmesis and functionality without the added cost of the bilayer dermal regenerative template.
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1. Background

Hidradenitis suppurativa/acne inversa (HS) is a chronic, inflammatory, recurrent, debilitating skin disease of the terminal hair follicle that usually presents after puberty with painful, deep-seated, inflamed lesions in the apocrine gland-bearing areas of the body, most commonly the axillary, inguinal, and anogenital regions [1–3]. The prevalence of HS is 0.3–4% in industrialized countries and primarily affects younger (mean age of onset of 23 years) individuals with a female to male ratio of 4:1 [2,4]. Axillae are one of the two most frequently affected sites; therefore, a great interest has developed in an effort to treat HS affecting axillae in a manner that is cost effective, well tolerated by the patient, expedient, and definitive [4,5].

Pathogenesis and etiology of HS has often been disputed and previously conceived as a disorder of apocrine origin; however, it is now widely accepted that the key component of HS pathogenesis involves follicular infundibular occlusion as opposed to inflammatory or infectious processes of the apocrine glands, primarily [6,7]. The apocrine glands still play a critical role in pathogenesis as evidenced by the age of onset of the disease. Patients with HS present in post-pubertal ages (following maturation of apocrine sweat glands of the axillae, groin, inframammary folds, etc.) [6]. There have been rare cases of individuals presenting prior to 10 years of age; however, these individuals suffered from precocious puberty resulting in an increase in apocrine gland

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development/maturation [6]. Patients with HS typically present with complaints of burning, itching, tenderness, and hyperhidrosis of the affected areas, which tend to be violaceous in appearance [6,8]. The disease process originates from follicular occlusion of terminal hair follicles (located deeply within the dermis) resulting in neighboring apocrine inflammation [1,2,6]. Follicular occlusion with subsequent rupture results in extensive and deep dermal inflammation which leads to the development of epithelialized, fistulous tracts [1]. Occlusion and rupture of follicular units occurs simultaneously with healing and cicatrization leading to a permanently altered dermis resulting in a chronic recurring process of draining fistulous tracts and abscess formation [1,2,6]. The process of chronic scar formation, leading to sinus tract formation, is what creates a hospitable environment for various species of Staphylococcus and Streptococcus organisms to grow [7,8].

The diagnosis of HS is based primarily on clinical findings, and is often initially misdiagnosed as an acute folliculitis [4]. Various staging systems have been created in an attempt to objectify and clarify severity of the disease; Hurley's 3 stages are the most frequently utilized. Stage I consists of an abscess formation (single or multiple) without sinus tracts and cicatrization. Stage II is characterized by one or more widely separated recurrent abscesses with tract formation. Lastly, stage III relates to multiple interconnected tracts and abscesses in a focal area [6,9].

Numerous risk factors have been identified in HS development and progression. Obesity, family history, cigarette smoking, female gender, and African American ethnicity have all been well observed as risk factors in the development of HS [4]. Of note, the aforementioned risk factors are not primary causes of HS; instead, they are strongly associated with HS and potentially exacerbating [6].

A wide variety of conservative treatment options including oral/topical antibiotics, oral steroids, injectable steroids, and retinoids have been used for treatment of HS, unfortunately many of the proposed treatments are ephemeral in terms of disease regression commonly resulting in relapse following completion of therapy [6,10]. To this date, radical excision of the affected areas with split thickness skin graft or flap placement has proved to be the most effective treatment modality with lowest recurrence rates [6,10]. Outcomes following radical excision without graft or flap placement using primary closure have demonstrated unacceptably high recurrence rates ranging from 54 to 69%. These results are likely due to inadequate excision margins in an attempt to ensure adequate tissue for primary closure [6,10].

Upon review of recent literature detailing the use of staged excision and skin grafting of bilateral axillary HS, we discovered a study by Gonzaga et al., entitled, "Novel Surgical Approach for Axillary Hidradenitis Suppurativa Using a Bilayer Dermal Regeneration Template: A Retrospective Case Study." This study reported great success in the management of axillary HS with the use of bilayer dermal regeneration templates (BDRT), Integra (Integra Life Sciences Corp., Plainsboro, NJ) with subsequent skin grafts [11]. Their study covered 4 patients with varying degrees of involvement ranging from Hurley stage II-III affecting bilateral axillae to more extensive perineum involvement [11]. Hospital charges in the USA rendered by the 4 patients ranged from $48,235 to $393,919. We realized that our staged excision with STSG for final closure was different from the aforementioned study in terms of timing and materials used; however, both methods resulted in similar outcomes. Not only were our outcomes similar, our methods proved to be more affordable and expeditious.

2. Methods

At our institution, we utilize a method for excision of HS with application of a STSG in a way that we believe to be the best balance between effective disease control and cost. Previously, we utilized NPWT systems following the application of the final wound closure with STSG, similar to Gonzaga et al. We have come to the realization that the added cost and time involved in placement, maintenance, and removal of the device is not warranted because of the results achieved when utilizing fibrin glue (applied to the recipient site prior to placement of STSG) and a bolster dressing (created from gauze, suture, and Acticoat® [Smith & Nephew, London, United Kingdom]), which functions to prevent shearing forces on the newly placed STSG. Both the fibrin glue and bolster dressing creation have decreased overall costs for our patients as they have obviated the need for post-operative NPWT (which in our population typically requires admission secondary to lack of funding for home NPWT).

Our case study covers 7 patients ranging from ages 20 to 42, all of which had chronic HS with symptoms ranging from 1 to 20 years. Many of our patients had previously undergone multiple simple drainage procedures resulting in failed treatment of HS and were subsequently referred to our tertiary center for definitive treatment.

The treatment timeline is as follows: the patient arrives for surgery and is given pre-operative antibiotics 30–60 min prior to the incision. The procedure consists of excision of all sinuses, pits, scarring, and hair-bearing tissues of the axilla. Following excision of the affected areas, one sheet of silver impregnated gauze, Acticoat® (Smith & Nephew, London, United Kingdom), is cut into two pieces (with removal of the inner cotton layer) and placed over the wounds following thorough irrigation of the wound bed. We elect to place Acticoat® (Smith & Nephew, London, United Kingdom) dressing over the wound bed in addition to applying a black foam sponge for use with the NPWT system in efforts to ensure timely creation of a clean granulation bed for our future STSG. At the completion of the procedure, the patient is either sent home (if their insurance will pay for home NPWT) or admitted. The patient is brought back to the operating room on post-operative days 3 or 4 and placed under conscious sedation where the silver impregnated dressing and NPWT system are removed. At this time, the wound is cleansed with povidone-iodine or chlorhexidine gluconate solution and we replace the NPWT system without the addition of the silver gauze, as the wound bed is nonpurulent. Again, following completion of procedure, the patient is either discharged or admitted depending on insurance coverage for NPWT. The patient is brought back to the operating room between post-operative days 10 and 12 (from the initial procedure) for the final closure with grafting. General anesthesia is employed and NPWT is removed revealing healthy appearing granulation tissue covering the entire wound. Mechanical debridement of the superficial layers of granulation tissue is performed revealing healthy, deeper, fibrous tissue. Once the deeper fibrous layer is appreciated, hemostasis is achieved by use of electrocautery. The STSG is harvested (typically from the anterior thigh) and meshed to 1–1.5 and applied to the hemostatic, healthy wound bed after application of fibrin glue/Tisseel® (Baxter Healthcare Corp, Deerfield, IL). Following placement of STSG, we overlay N-terface® dressing (Winfield Laboratories, Richardson, TX), Acticoat® (Smith & Nephew, London, United Kingdom), and a dry bolster (fashioned from sterile gauze). Creation of the dry bolster consists of "fanning-out" a roll of gauze over the Acticoat® (Smith & Nephew, London, United Kingdom) followed by using an entire roll of gauze left in a roll formation that is held in place with 10–12 2.0 Vicryl® (Ethicon, Somerville, NJ) sutures placed into the border areas of the STSG and tied to one another as they cross over the dried roll of gauze. The dried gauze has two primary functions. First, the gauze absorbs any serous drainage. Secondly, it provides pressure to the STSG and limits the patient's shoulder abduction (to approximately 70–80 degrees to ensure contact in the concave axillary wound);