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ORIGINAL ARTICLE

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The role of negative-pressure wound therapy in the management of axillary hidradenitis suppurativa

Anne-Cecile Ezanno[1] | **Anne-Claire Fougerousse**[2] | **Philippe Guillem**[3] | **GEM Resoverneuil**

[1]Department of Gastrointestinal and Endocrine Surgery, Bégin Military Hospital, Saint-Mandé, France

[2]Department of Dermatology, Bégin Military Hospital, Saint-Mandé, France

[3]Department of Surgery, Clinique du Val d'Ouest, Ecully, France

Correspondence
Dr Anne-Cecile Ezanno, Department of Gastrointestinal and Endocrine Surgery, Bégin Military Hospital, 69 avenue de Paris, 94 160 Saint-Mandé, France.
Email: ezanno.annececile@gmail.com

KEYWORDS

axillary, hidradenitis suppurativa, negative-pressure wound therapy, wide surgical excision

Key Messages

- Multiple reconstructive modalities after wide axillary excisions have been described, including skin grafts, flaps and healing by secondary intention.
- NPWT for axillarywound management after wide excision is possible and is possible.
- The advantages of NPWT healing are reduced length of hospitalization, reduction in the number of postoperative complications and low recurrence rate (5%).
- NPWT was well-perceived by our patients and the satisfaction study suggests that patients satisfied with the surgery, because 75% them recommend the surgery to other patients with HS.

1 | INTRODUCTION

Hidradenitis suppurativa (HS), or acne inversa, is a chronic inflammatory dermatosis, which affects the apocrine glands and pilosebaceous unit, is a characteristic of the intertriginous regions and, more frequently, is found in the axillary and inguinal areas. It profoundly alters the quality of life of patients. The prevalence of HS is 0.3% to 4% in industrialised countries and primarily affects younger individuals (mean age of onset 23 years), with a female to male ratio of 4:1.[1] Several studies have shown that axillary involvement occurs in around 72% of cases, followed by perianal (32%), groin (24%) and mammary involvement (8%).[2,3]

A genetic factor with an autosomal dominant heritance has been identified in one-third of patients with HS.[2] Smoking and obesity are both well-known factors related to the development and severity of HS.[4,5]

The diagnosis of HS is made clinically, and biopsies are seldom required. Various staging systems have been created to objectify and clarify the severity of the disease. The Hurley staging system is most frequently used for HS. Stage I consists of a solitary or multiple isolated abscesses, without sinus tracts or scarring. Stage II is characterised by recurrent abscesses, single or multiple widely separated lesions, with sinus tract formation, and stage III relates to diffuse or broad involvement across a regional area, with multiple interconnected sinus tracts and abscesses.[6] Clinical management with topical and systemic antibiotics has been described, as well as more recently, the use of immunosuppressants, such as inhibitors of tumour necrosis factor (TNF)$-\propto$, with encouraging results.[7-10] In severe cases of HS, medical therapy

GEM Resoverneuil: French Multicentric Study Group.

alone is inadequate, and wide local excision of all skin in the affected region offers the best hope for local disease control.[2] The most common surgical procedures are incision with drainage, deroofing and limited or wide excision. Incision with drainage is usually performed in acute stages to drain pus from abscesses and to relieve pain, but recurrence rates of up to 100% have been reported.[2,11,12] Deroofing is a surgical technique that consists of surgical removal of the skin covering a tunnel, laying open the partially tunnel floor for healing by secondary intention. It has been proposed as an efficient means for recurrent lesions in a mild phase of the disease.[13] If the disease is localised, limited excision can be performed. Simple local excision includes the removal of the entire sinus tract and can be closed directly. This technique has a short duration of care but a very high recurrence rate. Mehdizadeh et al [12] in a systematic review and meta-analysis published in 2015 showed a recurrence rate of 13% for wide excisions and 22% for limited excisions. Wide excision is the standard treatment for advanced cases. However, it creates a large defect. Hence, the problem with wide local excision is how to close the defect. Several studies have examined different methods of closure after excisions of HS, including skin grafts, locoregional and free flaps and healing by secondary intention.[2,3]

Wide local excision in the axillary areas often leads to large defects that are difficult to close primarily as function and range of motion are prioritised.[14] This is probably the reason why surgical techniques used to reconstruct axillary defects include the most numerous options.[15] Wound healing by secondary intention provides good results, and recent studies have confirmed the success of earlier reports.[15] This procedure has essentially one disadvantage: a long recovery time (several weeks), with heavy dressings. To try to reduce the axillary healing time, several other techniques have been developed. Split-thickness skin grafts (STSG) or flaps have shorter healing time and give satisfactory results but need immobilisation of the arm, leave sequelae in the donor sites and do not always prevent retractile scarring. Furthermore, the aesthetic result is pretty poor[16] and concerns persist about the recurrence rate as compared with healing by secondary intention. British guidelines [10] consider healing by secondary intention or thoracodorsal artery perforator (TDAP) flap closure for axillary wounds in people with HS following extensive excision. Therefore, to date, no randomised study has demonstrated an optimal approach to the surgical treatment of axillary HS, and none of the surgical procedures are superior to the others.[17]

The current study aimed to describe and evaluate the results of the use of negative-pressure wound therapy (NPWT) as a method of healing axillary defects after wide surgical excision for HS.

2 | METHODS

We designed the study as a retrospective analysis in surgery department in Begin Hospital, St Mandé, France. This study is based on the review of all consecutives patients undergoing surgical treatment for axillary HS between September 2017 and December 2019 and treated with combined wide surgical resection and NPWT. Surgery was indicated essentially for Hurley stages II and III, after antibiotic failure.

2.1 | Surgical technique

For each patient, we performed a radical wide excision in the operating room under general anaesthesia. Complete excision of all involved skin and subcutaneous tissue was performed. The width and depth of dissection were guided by extent of disease, with a disease-free surgical margin of 1 cm. The surgical specimen was sent to the pathologist. The final dressing for all patients was an NPWT system set at 100 mmHg. This was changed every 2 to 3 days and establishes for a maximum period of 15 days after surgery. After stopping TPN, patients had daily care with alginate wicking.

2.2 | Postoperative wound care

The goal of postoperative wound care was to maintain a moist and clean wound, being achieved with wound dressing changes. Patients were followed up 2 weeks postoperatively and subsequently every month until complete wound healing was achieved.

Demographic data were collected on age, sex, comorbidity, smoking, body mass index, American Society of Anesthesiologists (ASA) score duration of the disease and HS treatment. The severity of HS was classified using the Hurley classification.[6] Operative variables that were measured included operating time, size of excised area (according to the pathology reports), hospital stay, duration of NPWT, complications, time to complete healing and recurrence of HS.

We assessed patients' satisfaction by using a standardised form. The form consisted of questions:

1. Are you satisfied concerning shoulder mobility?
2. Are you satisfied concerning aesthetic results?
3. Are you satisfied concerning NPWT?

TABLE 1 Patients demographics

		Number of patients (*n*, %)	Mean ± SD	Ranges
Patients		20		
	Men	8 (40%)		
	Women	12 (60%)		
Age (years)			27.1 ± 7.7	15 to 40
BMI (kg/m^2)			28.2 ± 5	20.3 to 42.5
Tabaco (yes)		11 (55%)		
ASA score				
	ASA 1	9 (45%)		
	ASA 2	11 (55%)		
Medical treatments				
	Systemic antibiotics	15 (75%)		
	Anti-TNF	2 (5%)		
Disease duration years			7.1 ± 6.7	1 to 20
Age of illness onset			19.9 ± 5.7	11 to 37
Patients with unilateral excision			4 (20%)	
Patient with bilateral excision			16 (80%)	
Size of the operated axilla	35			
	Left	17 (48.6%)		
	Right	18 (51.4%)		
Hurley's stage				
	Stage 2	10 (50%)		
	Stage 3	10 (50%)		

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; TNF, tumour necrosis factor.

4. Would you do this surgery with NPWT again?
5. Would you recommend the surgery to another HS patient?

For each question, one answer was possible: completely satisfied, partially satisfied, moderately satisfied, not completely satisfied and not at all satisfied. The patients were interviewed by the same person either in consultation, by telephone or by e-mail.

The judgement criteria were length of hospitalisation, time to complete healing, complications, patient satisfaction scores about the surgery and the presence or absence of local recurrence of the disease.

2.3 | Statistical analysis

Continuous variables are presented as means (standard deviations [SDs]) or medians (ranges), and categorial variables are presented with numbers (%). We used an Microsoft Excel spreadsheet, in its version of Microsoft Office 2019, to tabulate the data, and XLStat software to perform the statistical analysis.

3 | RESULTS

3.1 | Population characteristics (Table 1)

In this retrospective study, we analysed data from 36 surgical procedures consecutively performed for 20 patients with HS between 2017 and 2019 (16 patients underwent bilateral procedures and 4 underwent unilateral procedure). The mean age of patients was 27.1 ± 7.7 years, 60% were female, the average BMI was 28.2 ± 5 kg/m^2 and 55% were smokers. The Hurley stage at surgery was III for 10 (50%) patients and II for the remainder of the patients. The mean duration of disease before surgery was 7.1 ± 6.7 years. Fifteen patients (75%) had received treatment with antibiotics, and five patients (15%) had received treatment with anti − TNF $\propto$.

TABLE 2 Results

	Number of patients (*n*, %)	Mean ± SD	Extremes
Excised area (cm^2)		46.6 ± 43	10 to 195
Operative time (minutes)		39.4 ± 13	20 to 64
Length of hospitalisation (days)		3 ± 0.2	3 to 4
Length of NPWT healing (days)		18.5 ± 9	5 to 39
Length of complete healing		115 ± 85	21 to 407
Complication	5 (25%)		
Infection	2 (5.7%)		
Bleeding	0		
Pain	4 (11.4%)		
Loss of mobility	1 (2.8%)		
Length of follow-up (days)		375.5 ± 226.3	37 to 764
Recurrences of HS	1 (5%)		

Abbreviations: HS, hidradenitis suppurativa; NPWT, negative-pressure wound therapy.

FIGURE 1 A, Before wide excision. B, After wide excision. C, negative-pressure wound therapy (NPWT). D, 2 months after wide excision

3.2 | Surgical characteristics (Table 2 and Figure 1)

Each patient was free to choose a unilateral or bilateral procedure (in cases of bilateral pathology). Among the 20 patients, 16 (80%) patients underwent bilateral procedures. The average excised area was 46.6 ± 43.0 m^2, and the mean operative time was 39.4 ± 13 minutes. The average length of hospitalisation was 3 days. The average duration of NPWT was 18.5 ± 9 days, and the mean complete healing

TABLE 3 Satisfaction study

	Not at all (*n*, %)	Not totally (*n*, %)	Moderately satisfied (*n*, %)	Partially satisfied (*n*, %)	Completely satisfied (*n*, %)
1-Are you satisfied concerning shoulder mobility?	0	0	3 (15.8%)	7 (36.8)	9 (47.4)
2-Are you satisfied concerning aesthetic results?	1 (5.3%)	1 (5.3%)	3 (15.8%)	8 (42.1%)	6 (31.5%)
3-Are you satisfied concerning NPWT?	1 (5.3)%	0	2 (10.5%)	2 (10.5%)	14 (73.7%)
4-Would you do this surgery with NPWT again?	4 (21%)	1 (5.3%)	2 (10.5%)	4 (21%)	8 (42.1%)
5-Would you recommend the surgery to another HS patient?	2 (10.5%)	0	2 (10.5%)	3 (15.8%)	12 (63.2%)

Abbreviations: HS, hidradenitis suppurativa; NPWT, negative-pressure wound therapy.

time was 115 ± 85 days. Among the 36 procedures, there were five (13.8%) complications. The most frequent were pain (11.4%), infection (5.7%) and loss of mobility (2.8%). None of the complications required a new hospitalisation.

3.3 | Follow-up and recurrence

The mean follow-up was 412.5 ± 195.2 days. We recorded only one recurrence among the 19 patients who were followed. One patient was lost to follow-up 3 months after surgery.

3.4 | Satisfaction study (Table 3)

Among the 20 patients, 19 patients returned the satisfaction form. For shoulder mobility results, a total of 9 (47.4%) patients were completely satisfied, 36.8% were partially satisfied, and 15.8% were poorly satisfied. For the aesthetic results, only 6 (31.6%) patients were completely satisfied. Concerning NWPT, 14 (73.7%) patients were completely satisfied, with only 8 (42.1%) patients accepting another surgery with the same procedure. In all, 12 (63.1%) patients would recommend this surgery to another patient (Table 3). The average score on the satisfaction questionnaire was 20.5 ± 4.2 points (min 11–max 25).

4 | DISCUSSION

Multiple reconstructive modalities after wide axillary excisions have been described, including skin grafts, flaps and healing by secondary intention. Much discussion has been dedicated to determining the ideal postexcisional reconstructive modality, with pertinent outcomes of local disease recurrence rate, time to complete healing, donor site morbidity, function and aesthetics. Healing by secondary intention after excision of HS has been described, with successful wound healing results,[18] and seems to have less pain than grafting,[19] cosmetically acceptable scars, lack of donor sites, no flap or graft loss and an acceptable range of motion with a low incidence of contractures.[18] Disadvantages include relatively long healing times, painful dressing changes, need for meticulous wound care and risk of wound contracture, particularly with large excisions. The TDAP and STSG in the management of chronic axillary HS improved the time to healing. However, these methods have significant morbidities and donor-site limitations. Moreover, STSGs and flaps increased both operative time and length of hospitalisation, as well as may lead to an increased number of surgical procedures.[20] Chen et al demonstrated in 2011[21] that only the extremely huge defects will require a skin graft or flap,[21] but in some cases, the excision creates very large skin defects such that local or perforator flaps may not be adequate for the reconstruction.[12,22,23]

According to the patient's choice, wound size and all the disadvantages already mentioned for skin grafts or flaps, our centre prefers wound healing by secondary intention. We argue that wound healing by secondary intention has advantages, including cosmetically acceptable scars, lack of donor sites, no flap or graft loss and functional outcomes with a low incidence of contractures.[18] Moreover, in a small study ($n = 10$), Morgan et al[19] implied that patients possibly prefer healing by secondary intention over skin grafting. Bieniek et al[24] demonstrated favourable cosmetic results with healing by secondary intention after surgery for HS. In order to reduce the healing time, we proposed a two-step healing strategy. The use of NPWT for 2 weeks on an open wound created after wide excision of HS lesions to remove residual infections provided drainage and improved perfusion before secondary healing with mesh.

TABLE 4 Summary of articles on surgical interventions in patients with axillary hydratenitis suppuritiva published since 2010

Study, year	No. of patients	Closure type	Length of surgery (min)	Excised area (cm^2)	Length of hospitalisation (day)	Length of healing (days)	Complication (n; %)	Recurrence rate (%)	Length follow up (month)
Busnardo et al (2011)[32]	12	Flap	ND	ND	ND	ND	ND	38.8%	6 months
Afsharfard et al (2020)[17]	13	STSG and flap	ND	ND	ND	ND	ND	0	1 year
Wormald et al (2014)[33]	27	Graft and flap	146.5 ± 69.8	ND	5.6 ± 2.9	70.7 ± 89.6	ND	3.7%	1 year
Ortiz et al (2010)[34]	16	Thoracodorsal artery perforator flap	ND	ND	ND	ND	ND	0	ND
Marchesi et al (2018)[25]	17	Thoracodorsal artery perforator flap	151 ± 31	94.5 ± 38	1 to 5	20 ± 9	N = 6; 35%	ND	ND
Pearce et al (2017)[26]	7	NPWT + STSG	ND	335	8.8 ± 4	38.7 ± 15,3	ND	ND	1 months
Elgohary et al (2018)[30]	20	Thoracodorsal artery perforator flap	210 ± 25	Range 96 to 204	6 ± 3	ND	N = 7; 35%	ND	30 months ± 5.2
Elboraey et al (2019)[31]	6	Propeller flap	ND	Range 66 to 252	4	ND	N = 2; 33%	0	10 months mean
Ching et al (2017)[35]	4	Transposition flap	ND	ND	ND	ND	N = 1; 25%	0	18 months
Wu et al (2020)[28]	34	Rotation flap	4 ± 16	84	0	ND	N = 13; 25%	10%	32 months
Gonzaga et al (2013)[27]	4	Graft with bilayer dermal regeneration	ND	Range 200 to 300	ND	ND	N = 1; 25%	0	23 months
Hallock et al (2013)[36]	2	Thoracodorsal artery perforator based V-Y advancement	ND	90	ND	45,5	1 (minor)	0	9.5 months
Varkarakis et al (2010) [37]	15	Rotation flap	ND	212	ND	ND	N = 4; 26.6%	0	12 months
Nail-Barthelemy et al (2019)[16]	13	Perforator flap	76.2 ± 18.8	58 ± 31.5	5.1 ± 3.1	20.5 ± 13.5	N = 6; 46%	0	9 months
Calibre et al (2013)[38]	5	Skin grafting + NPWT	ND	ND	ND	34 (20–43)	0	ND	ND
Jandali et al (2013)[29]	9	Thoracodorsal artery perforator	ND	74	ND	ND	N = 2; 22;%	11.1%	20 months
Mean	**12.7**		**125.94**		**4.9**	**38.2**	**26.4%**	**1.4%**	**±15**

Abbreviations: NPWT, negative-pressure wound therapy; STSG, split-thickness skin graft.

Our time to complete healing was higher than that in previous studies and this whatever the mode of wound care: grafts flaps or secondary intention (115 days). The average excised area was 46.6 ± 43 cm^2. This size seems to be lower than that in other studies.[16,25-31] In this analysis of 35 wide excisions with wound healing with NPWT, the operative time was 39.4 minutes, and length of hospitalisation was 3 days. A systematic review of the literature on axillary surgery for HS (Table 4)[16,17,25-29,31-38] from 2010 to 2020 showed a mean operative time of 125.9 minutes, mean length of hospitalisation of 4.9 days and time to complete healing of 38.2 days. However, in several studies, these points are not reported, which makes comparisons to our study difficult. The studies carried out essentially sought to evaluate the rate of recurrence, mobility of the shoulder and aesthetic results, as well as time to healing after excision of HS. The scant data available described a time to healing between 20 and 150 days.[14,39-41]

In this study, we measured the local recurrence rate of HS at 5% (one patient) with a mean follow-up of 1 year. The recurrence risk after wide excision was estimated at 6% to 38%.[18,42-44] Recurrence rates were reported for primary closure (54%–70%),[45] STSGs (0%–33%)[18,46,47] and flaps (0%–6.6%).[18,33,37] Our recurrence rate seems very low and must be confirmed with a longer follow-up study. Mehdizadeh et al,[12] in a systematic review and meta-analysis published in 2015, showed a recurrence rate of 13% (95% CI 5.0–22.0) for wide excisions and 22% (95% CI 10.0–37.0) for limited excisions. Fertitta et al[43] updated this analysis from 2015 to 2019 and found a recurrence rate between 12.4% and 54.2%.

For severe cases, NPWT has been developed and is commonly used in the management of open and contaminated wounds nowadays.[48] NPWT in HS has been used more frequently in severe perineal cases.[21,39-41] It has been suggested that this system improves wound healing by increasing blood flow and formation of granulation tissue, reducing the bacterial load and thereby reducing the size and complexity of the wound.[39,48,49] It should be noted that in this series, the patients benefited from an average of 18.5 ± 9 days of healing by NPWT. In two cases, the TPN healing method was stopped earlier than expected (before the 15th day) because of pain during dressings. This is quite frequent with this device in spite of adapted analgesics.

In our study, the satisfaction score seems high, with an average score of 20.5 points (out of 25 points). We deliberately chose to create a satisfaction questionnaire for our patients, because we did not find an appropriate questionnaire in the literature. The 'DLQI' is a tool often used to assess the quality of life of many dermatologic diseases, but it was not routinely given pre-operatively to our patients. We admit that our questionnaire, which is very simple and non-specific, has its own limitations and is not as standardised as the DLQI. However, it allows us to see that the NPWT was well-perceived by our patients. The satisfaction study suggests that patients were completely or partially satisfied with the surgery because 75% them recommend the surgery to other patients with HS.

4.1 | Limitations

The limitations of our study are its lack of power (because it is a single-centre retrospective study), small sample size and lack of an arm to compare the results to the use of healing by secondary intention without NPWT. Therefore, this study aims to be a preliminary work to further studies.

5 | CONCLUSION

Axillary HS is a difficult disease to manage. Several reconstructive modalities after wide axillary excision have been described, but none have shown their superiority. Our study allows to show despite the small number of patient that the use of NPWT for axillary wound management after wide excision in HS is not only safe and simple but also has a shorter operative time and hospital stay, with an acceptable complication rate and lower recurrence rate.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

INFORMED CONSENT

The patients in this manuscript have given written informed consent to publication of their case details.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions.

ORCID

Anne-Cecile Ezanno https://orcid.org/0000-0003-0270-5090

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SUPPORTING INFORMATION

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