Giornale Italiano di Dermatologia e Venereologia
EDIZIONI MINERVA MEDICA

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Giornale Italiano di Dermatologia e Venereologia 2018 Oct 04
DOI: 10.23736/S0392-0488.18.06196-5

Article type: Original Article

Article first published online: October 04, 2018
Manuscript accepted: September 26, 2018
Manuscript received: September 10, 2018

Comparison of clinical and sonographic scores in hidradenitis suppurativa and proposal of a novel ultrasound scoring system

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All the authors state that they do not have received any funding.

The authors do not have conflict of interest to declare.

Abstract

BACKGROUND. Hidradenitis suppurativa (HS) is a chronic, inflammatory disease that presents with nodules, abscesses and fistulae affecting the apocrine gland-bearing skin. Since few years, ultrasonography is used to better characterize HS skin lesions but comparison between clinical and sonographic scores has been made only in small series of patients.

The aim is to assess concordance between clinical and sonographic scores in a larger cohort of HS patients.

METHODS. We conducted a retrospective observational study on 140 HS patients comparing two clinical score systems, Hurley and HS-Physical Global Assessment (PGA), with two ultrasonographic scores, SOnographic Score of Hidradenitis Suppurativa (SOS-HS) and ultrasonographic HS-PGA, a novel ultrasound scoring system set up by our group. We used the weighted Cohen's Kappa statistic (k) to evaluate the agreement.

RESULTS: Agreement between Hurley staging and SOS-HS was found in 61.4% of patients (weighted kappa 0.477), while agreement between clinical and ultrasonography HS-PGA scores was found in 35% of patients (weighted kappa 0.278), both findings suggesting a substantial disagreement.

CONCLUSIONS. Our study demonstrated a relevant disagreement between clinical and ultrasonography scores. Ultrasonography discovered non-clinically evident HS lesions, notably fistulae. Taken together, the above findings may support the view, previously suggested in expert panel reports, on the higher sensitivity of ultrasonography compared to clinics in HS.

Keywords: hidradenitis suppurativa; Hurley classification; ultrasonography; ultrasound; power doppler

Introduction

Hidradenitis suppurativa (HS) is a chronic, recurrent, inflammatory skin disease characterized by painful nodules, abscesses and sinus tracts in the apocrine gland-bearing areas of the body [1]. Nowadays, HS is considered as an autoinflammatory diseases with proinflammatory cytokines like interleukin (IL)-1, IL-17 and tumor necrosis factor (TNF)-α playing a crucial role in its pathogenesis [2-6] on a genetic background [7; 5] and with factors like smoking, obesity and hormons aggravating its course. It is considered an emerging debilitating disease, affecting young individuals, especially in the third and forth decade, with a strong female preponderance and a tremendous impact on the quality of life. The diagnosis is based on the clinical presentation and, during the last years, many physician-rated scoring systems of HS have been proposed in order to assess the disease severity, address therapy and evaluate the clinical response [8]. The most used severity assessment score is the Hurley staging classification [9], proposed in 1989, which distinguishes three stages of disease: stage I if one or more abscesses with no sinus tract or scarring are present; stage II, in which there are separated recurrent abscesses with at least one sinus tract and scarring; stage III if the entire affected area presents with multiple, interconnected sinus tracts and abscesses. The Hurley classification is a straightforward score, although it is a little static and not useful for follow-up evaluation.

Ultrasonography has been introduced in HS to better assess the disease severity [10-13], whose evaluation has been traditionally based on the clinical examination with its intrinsic limitations, as in the Hurley classification [9]. In fact, the palpation has low sensitivity in particular for the diagnosis of deeper HS lesions like nodules, sinuses or fistulous tracts, which are critical in assessing the disease severity and choosing the appropriate therapeutic regimen. Sonographic criteria for diagnosing HS were proposed by Wortsman et al in 2013 [11], and include: 1) widening of the hair follicles; 2) thickening or abnormal echogenicity of the dermis; 3) dermal pseudocystic nodules; 4) fluid collections; 5) fistulous tracts. A three-stages scoring system, named SOnographic

Score in Hidradenitis Suppurativa (SOS-HS), was also suggested by the same authors: stage I includes patients showing the previous reported dermal changes affecting a single body segment with single fluid collection and without fistulous tract; stage II includes patients with two to four fluid collections or a single fistulous tract; stage III includes patients with more than four fluid collections or two or more fistulous tracts or the involvement of at least three body segments. Kimball et al adopted a HS specific scoring system, Physician Global Assessment (HS-PGA) [14]: the latter is a six-stage classification system ranging from 0 (clear) to 5 (very severe), which is based on the counting of non-inflammatory and inflammatory nodules, abscesses and fistulous tracts. In this paper, we propose a novel ultrasound scoring system for assessing the disease severity, named US HS-PGA, on the basis of the homologation of clinical and ultrasonographic categories of severity.

Furthermore, we report the results of a retrospective observational study comparing clinical and ultrasonographic scores in a large cohort of HS patients from a single Italian dermatology department to assess the agreement between clinics and ultrasonography. A disagreement between clinical and ultrasonographic scores could indirectly support the higher sensitivity of ultrasonography as compared to clinics in HS, as previously suggested [11-13], emphasizing the usefulness of ultrasonography as a noninvasive test for staging and monitoring patients.

Materials and methods

We performed a retrospective observational study considering patients with a clinical and ultrasonographic diagnosis of HS. Only HS patients with visible lesions were included. Each patient was clinically evaluated and classified according to Hurley staging and clinical HS-PGA. HS-PGA is a scoring system still non-validated in HS; however, it is widely adopted [14], thus justifying its use in clinical studies on this disease.

Ultrasonography was performed in the same day of the clinical consultation in each apocrine gland-bearing areas, i.e. axillae, inguinal folds, perineal area and perianal region. We used Hitachi Arietta V70 sonographer with a linear 18-5 MHz multifrequency probe and classified each patient according to SOS-HS [11] and US HS-PGA. US HS-PGA is based on the definitions of anatomic abnormalities used for diagnosing HS and assessing disease severity in SOS-HS [13], namely: *i)* pseudocyst that ultrasonographically appears as a round or oval shaped hypoechoic or anechoic nodular dermal and/or hypodermal structure, less than 1 cm in diameter, corresponding to nodule on clinical examination; *ii)* fluid collection, i.e. hypoechoic or anechoic fluid dermal and/or hypodermal saclike structure connected to the base of widened hair follicles, corresponding to abscess; *iii)* fistulous tract, that is hypoechoic or anechoic dermal and/or hypodermal band-like structure connected to the base of widened hair follicles, corresponding to fistula.

For assessing disease severity in US HS-PGA, we used the scores of HS-PGA, including clear, minimal, mild, moderate, severe and very severe stages.

In the present study, in addition to ultrasonography, we used also Power Doppler in order to establish the presence of inflammation. We have chosen to evaluate only pseudocysts by means of Power Doppler for distinguishing between inflammatory and non-inflammatory nodules, not assessing HS lesions such as abscesses and fistulae that will the matter of future studies. We considered the presence of vascularization, its distribution - either peripheral or internal - and its intensity. Intensity was evaluated as follows: minimal if only color spots were detectable, moderate if some flow signals were visible, high if multiple flow signals were present. We considered a pseudocyst as inflammatory if vascularization, albeit minimal, was present.

Statistical analysis

We reported categorical data as counts (percentages) and continuous variables as means ± standard deviations or medians (ranges), as appropriate.

We calculated the weighted Cohen's Kappa statistic (k), with 95% confidence interval (CI), to evaluate the agreement between clinical and ultrasonographic scores and between Hurley staging and SOS-HS. We classified agreement as good/excellent (k>=0.60) or poor/moderate (k<0.60). We used SAS statistical software (version 9.4, SAS Institute Inc., Cary, NC) for the analyses.

Results

In a period of two years, from July 2015 to July 2017, we performed ultrasonography in 140 HS patients: 83 patients (59.3%) were women and 57 patients (40.7 %) men with age ranging from 12 to 77 years (median 31 years;). The most frequent sites were: contemporary involvement of groins and axillae (53 patients, 37.9%), only groins (45 patients, 32.1%) and only axillae (25 patients, 17.9%). Other locations were the buttocks (12 patients, 8.6%) and the trunk (5 patients, 3.6%).

In our study, there was an inter-operator consensus on clinical assessment scores among clinicians, who performed clinical examination only (five operators: E.G., S.M., M.B., S.V., A.V.M.) as well as on ultrasonographic scores between ultrasound operators, who performed ultrasonography (two operators: G.N., E.P.).

Hurley staging vs SOS-HS

Thirty-five patients (25%) were in Hurley I stage, 70 patients (50%) belonged to Hurley II stage and 35 patients (25%) were classified as Hurley III stage. Based on the ultrasonographic evaluation, twenty-nine patients (20.7%) were assessed as SOS-HS I, 66 patients (47.1 %) as SOS-HS II and 45 patients (32.1%) as SOS-HS III (Figure 1A-F).

In only 61.4% (n= 86) of the observations there was agreement between Hurley staging and SOS-HS (weighted kappa 0.477; 95% CI 0.361 to 0.593) (Table 1).

HS-PGA vs US HS-PGA

Table 2 shows HS-PGA clinical and ultrasonographic scores: there was agreement in only 35% (n=49) patients (weighted kappa 0.278; 95% CI 0.198 to 0.359).

Power Doppler assessment

We assessed by means of Power Doppler 26 HS lesions clinical classified as non-inflammatory nodules, confirming only 6 of them. The remaining 20 lesions were re-classified as inflammatory nodules using Power Doppler due to the presence of vascularization (Figure 2A, B).

Discussion

Hidradenitis suppurativa is a chronic inflammatory disease characterized by deep - dermal and/or subdermal - lesions, that make the clinical examination alone not sufficient to assess the actual severity and activity of the disease. Sonographer equipped with high frequency probes has been used in dermatology to study this disease since 1997 [15]. In 2013, Wortsman et al proposed a novel ultrasonography staging system, named SOS-HS, and studied 34 HS patients using the classic clinical Hurley staging and ultrasonography SOS-HS staging [11] In this study, the authors found a low concordance between SOS-HS and Hurley [(k) = 0.27], suggesting clinical scores underestimate the severity of the disease.

Our study, which demonstrated a fair concordance between clinical and ultrasonographic scores, mainly discovering non-clinically evident fistulae, may support the higher sensitivity of ultrasonography compared to clinics, as previously suggested [11, 13]. We confirmed in a larger

cohort of HS patients the first results of Wortsman et al who used the three-stage ultrasound system SOS-HS [11].

For assessing more accurately disease severity, we used also a six-stage clinical scoring system, HS-PGA, and proposed an equivalent ultrasound system, US HS-PGA, in order to stratify the patients in six stages from clear (0) to very severe (5). In our study, it is noteworthy that concordance between clinical and ultrasonographic HS-PGA scores was even lower than that using the three-stage scoring systems. Only in three patients the ultrasonographic scores were lower than the clinical scores, in 49 cases there was agreement (35% of the observations) and in the remaining 88 cases the ultrasonography score was higher than the clinical score.

The presence of vascularization is another important parameter in the ultrasound evaluation of HS lesions and may be better disclosed using Power Doppler. To the best of our knowledge, the only study assessing vascularization in HS by means of Power Doppler is that of Caposiena Caro et al [16], in which demonstrated a higher vascularization in abscesses and fistulae than in nodules, suggesting that this method is more useful than conventional ultrasonography for evaluating disease activity. In the present study, we applied Power Doppler only to HS nodules and this method allowed us to classify as inflammatory lesions diagnosed as non-inflammatory on clinical examination.

The main limitation of our study consists in the lack of a reference standard. In the absence of a reference standard we have not been able to calculate sensitivity and specificity for both ultrasonography and clinical evaluation. Moreover, unlike the aforementioned study [11], in our cohort the percentage of cases staged as SOS-HS II and III were much higher than the cases staged as SOS-HS I, suggesting that the composition of our sample might significantly affect the comparison of ultrasound staging systems. On the other hand, based on a recently published expert consensus report [13] which emphasized that ultrasonography discovers non-clinically evident HS lesions as seen in our study, we can reasonably assume that the observed disagreement between

ultrasonography and clinical evaluation, more evident at higher HS stages, is due to the higher sensitivity of ultrasonography.

In conclusion, we suggest performing ultrasonography examination in all HS patients for staging the disease severity, addressing the more appropriate therapeutical approach, and monitoring the clinical response. Moreover, we think that vascularization should always be investigated because its modification is directly related to the activity of the disease.

Acknowledgements:

Financial support NONE.

Conflict of Interest. NONE

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	SOS-HS I	SOS-HS II	SOS-HS III	Total
Hurley I	15	19	1	**35 (25.0%)**
Hurley II	13	42	15	**70 (50.0%)**
Hurley III	1	5	29	**35 (25.0%)**
Total	**29 (20.7%)**	**66 (47.2%)**	**45 (32.1%)**	**140**

Table 1. Concordance between Hurley and SOS-HS (k = 0,477)

clinical	sonographic	Clear	Minimal	Mild	Moderate	Severe	Very severe	Total
Clear		0	0	0	0	0	0	**0**
Minimal		0	6	11	7	1	1	**26 (18.6%)**
Mild		0	3	32	27	10	1	**73 (52.2%)**
Moderate		0	0	0	10	26	2	**38 (27.1%)**
Severe		0	0	0	0	0	2	**2 (1.4%)**
Very severe		0	0	0	0	0	1	**1 (0.7%)**
Total		**0**	**9 (6.4%)**	**43 (30.7%)**	**44 (31.5%)**	**37 (26.4%)**	**7 (5.0%)**	**140**

Table 2. Concordance between clinical and sonographic HS-PGA (k = 0,278)

Legend

Figure 1.

A, B. Hurley I. Hidradenitis suppurativa nodule on clinical examination (**A**). Sonographic features of the same lesion (**B**)

C, D. Hurley II. Hidradenitis suppurativa abscess on clinical examination (**C**). The same lesion seen on ultrasonography (**D**)

E, F: Hurley III. Hidradenitis suppurativa linear fistula on clinical examination (**E**). The same lesion evaluated by means of ultrasonography (**F**).

Figure 2.

A. Hidradenitis suppurativa nodule clinically diagnosed as non-inflammatory

B. Power Doppler revealing the inflammatory nature of the same lesion