Grading system of acnes vulgaris

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Abstract

Background: Acne vulgaris is an inflammatory disease of the pilosebaceous unit, consisting of comedones, papules, pustules, nodules, and cysts. With the complexity of polymorphic nature, acne vulgaris is inherently difficult to assess and the measurement and grading of this condition is a recognized challenge for clinicians. This article presents a comprehensive preview of acne severity assessment according to timelines to give an overview of methods used to measure acne severity. **Methods:** A systematic search of the literature was performed to identify publications describing acne classification methods. Many combinations of search terms were used with the help of search engines consisting of Pubmed, Google Scholar, Uptodate, and Medscape. **Results:** 31 documents were retrieved, of which seven articles were removed because the full-text copy could not be found. After reviewing the content of 24 documents, 12 were excluded as they did not focus on acne outcome instruments, did not present a novel approach, did not focus on assessment of physical symptoms, or were not reported in the English language. Finally, 12 methods were included in the review. **Conclusion:** Acne vulgaris is a common disease, the diversity of classification is useful and allows clinicians to choose a variety of assessment and investigation methods.

Keywords: *acne vulgaris - assessment - classification - evaluation - severity - scale.*

1. INTRODUCTION

Acne vulgaris is a common dermatological disorder characterized by chronic or recurrent appearance of facial comedones, papules, pustules, nodules, or many kinds of acne lesions on the neck, trunk, or proximal upper extremities [1]. It affects roughly 85% of people during adolescence, beginning in puberty and continuing into adulthood, with a peak incidence around the age of 18 [2]. Acne vulgaris has no systemic repercussions but may be a chronic inflammatory disease of the pilosebaceous unit including hyperkeratinization, increased sebum production, bacterial proliferation, and inflammation [3]. This dermatological disorder also involves physical and psychological morbidity, which can change the quality of life of the affected individuals [4].

A number of clinical assessment tools have been developed to grade acne severity and assess change over time, yet a standardized system for classifying the severity of acne has not been agreed upon. The severity of acne depends on lesion size, density, type, and distribution, which makes it difficult to create a uniform, qualitative method of assessment that is simple to use. Most methods include facial lesion counts and⁄or reference photographs of various body areas. To date, there are four broad approaches to the assessment of acne severity: lesion counting, global acne severity grading, subjective self-assessment, and multimodal digital imaging [5]. To be more specific, acne lesion counting involves the number of different lesion types without the aspect of symptoms including concentration, distribution, and size of lesions, or skin redness [6]. On the contrary, global severity grading is able to evaluate a range of aspects pertinent to severity, including the number, type, and size of lesions, but also the presence and coverage of inflammation, erythema, and seborrhea [6]. When subjective self-assessment is mentioned, it has been identified as an approach provided by patients based on perceived acne severity and quality of life [7]. Last but not least, multi-modal imaging, which is the best current assessment method, is the use of specialist photographic equipment, including ultraviolet A lamps, fluorescent lights, polarizers or digital cameras, and computer algorithms to capture and analyze lesion types, extent of erythema, and pigmentation disorders [8]. This review aims to summarize the grading and assessment of acne severity.

2. METHODS

A systematic search of the literature was performed in order to identify publications describing acne classification methods. Many combinations

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of search terms were used including acne vulgaris, assessment, classification, measurement, grading, evaluation, scale, outcome, and diagnosis with the help of search engines consisting of Pubmed, Google Scholar, Uptodate, and Medscape. Articles in the English language and in peer-reviewed, scholarly journals and dermatology textbooks were used and there was no limitation on the date of publication in this review. The papers were first reviewed based on their titles and abstracts, and then a full-text copy of the article was retrieved to confirm eligibility.

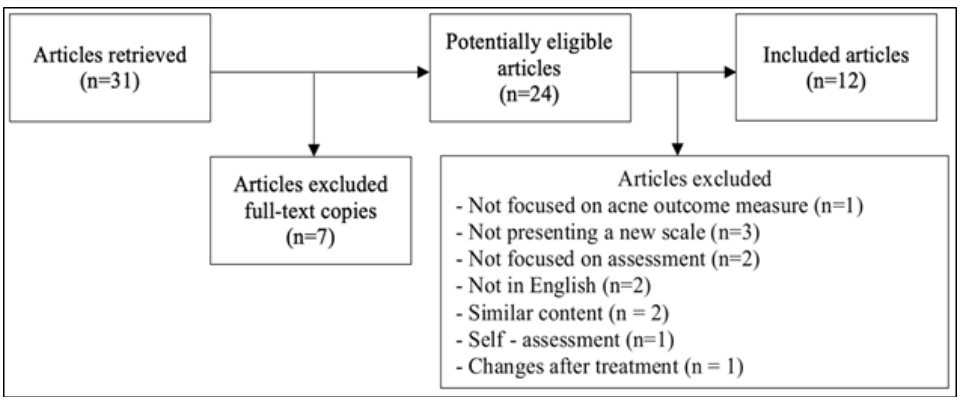

Fig-1. Summary of investigation method

3. RESULTS

There are more than 30 distinct acne severity evaluation methods have been announced globally. However, the existence of many rating systems indicates a lack of consensus on this issue, hence, no acne assessment system has been considered a universal standard.

In total, 31 documents were retrieved, of which seven articles were removed because the full-text copy could not be found. After reviewing the content of 24 documents, 12 were excluded as they did not focus on acne outcome instruments, did not present a novel approach or idea, did not focus on assessment of physical symptoms, or were not reported in the English language. Finally, 12 methods were included in this review (fig-1).

The first person to use the evaluation system for acne was Carmen Thomas of Philadelphia, who recorded the number of lesions counted during each consultation in the 1930s [9]. Nevertheless, it was not until 1956 that the first scoring scale was established by Pillsbury, Shelley, and Kligman, which had 4 grades based on an overall lesion type, number, and predominant lesions on the face and the upper aspects of the trunk [10]. The types of lesions used for classification in this initial rate include comedones, small cysts, small or large inflammatory papules and pustules, and other deeper lesions.

Table 1. Acne grading method

Year	Name of method	Description	
1956	Pillsbury et al 's grading system [10]	Grade 1	Comedones and occasional small cysts confined to the face
		Grade 2	Comedones with occasional pustules and small cysts confined to the face
		Grade 3	Many comedones and small and large inflammatory papules and pustules, more extensive but confined to the face
		Grade 4	Many comedones and deep lesions tending to coalesce and canalize, and involving the face and the upper aspects of the trunk.

1958	Grading system by James and Tisserand [11]	Grade 1	Simple noninflammatory acne - comedones and a few papules			
		Grade 2	Comedones, papules, and a few pustules			
		Grade 3	Larger inflammatory papules, pustules, and a few cysts; a more severe form involving the face, neck, and upper portions of the trunk			
		Grade 4	More severe, with cysts becoming confluent			
1971	Burton et al 's grading system [12]	Grade 0	Complete absence of any acne lesions			
		Grade 1	A few insignificant comedones, often in the erase lines			
		Grade 2	Mild acne, usually consisting of a few comedones and a few small papules or pustules (Clinical acne)			
		Grade 3	Moderate acne with prominent lesions			
		Grade 4	Severe acne, often with cysts			
		Grade 5	Extremely severe acne, with widespread inflammatory lesions and many large pustules or cysts			
1979	Acne grading method by Cook et al. [13]	0	Up to small scattered comedones and/or small papules are allowed			
		2	Very few pustules or three dozen papules and/or comedones; lesion are hardly visible from 2.5m away			
		4	There are red lesions and inflammation to a significant degree; worth treating			
		6	Loaded with comedones, numerous pustules; lesions are easily recognized at 2.5 m			
		8	Conglobata, sinus or cystic type acne; covering most of the face			
1997	The global acne grading system [14]	**Grade**	**Location**	**Factor (F)**	**Severity**	**Local Score (FxS)**
		Mild (1 - 18)	Forehead	2	No lesions 0	
			Right cheek	2	Comedone	
		Moderate (19 - 30)	Left cheek	2	Papule	
			Nose	1	Pustule	
		Severe (31 - 38)	Chin	1	Nodule	
		Very severe (> 39)	Chest and upper back	3		
		Total score				

2005	Overall inflammatory acne severity scale [15]	0	None	Clear, no inflammatory lesions
		1		Only an occasional small inflammatory lesion
		2	Mild	Few scattered small inflammatory lesions, with mild erythema present on less than half of the face
		3		Moderate number of inflammatory lesions over a wide area of the face, with increasing erythema
		4	Moderate	Moderate number of inflammatory lesions, some large, over a wide area of the face, with increasing erythema
		5		Papules and pustules with larger inflamed lesions over much of the face, with pronounced erythema
		6	Severe	Large papules and pustules with pronounced erythema involving most of the face
2007	Comprehensive Acne Severity Scale (CASS) [16]	0 Clear		No lesions to barely noticeable ones. Very few scattered comedones and papules
		1 Almost clear		Hardly visible from 2.5 m away. A few scattered comedones, few small papules, and very few pustules
		2 Mild		Easily recognizable; less than half of the affected area is involved. Many comedones, papules, and pustules
		3 Moderate		More than half of the affected area is involved. Numerous comedones, papules, and pustules
		4 Severe		Entire area is involved. Covered with comedones, numerous papules and pustules, and a few nodules and cysts
		5 Very severe		Highly inflammatory acne covering the affected area, with nodules and cysts present
2011	Global Acne Severity Scale [17]	0 Clear/No lesion		Residual pigmentation and erythema may be seen
		1 Almost no lesion		A few scattered open or closed comedones and very few papules
		2 Mild		Easily recognizable: less than half of the face is involved. A few open or closed comedones and a few papules and pustules
		3 Moderate		More than half of the face is involved. Many papules and pustules, many open or closed comedones. One nodule may be present
		4 Severe		Entire face is involved, covered with many papules and pustules, open or closed comedones and rare nodules
		5 Vere severe		Highly inflammatory acne covering the face with presence of nodules

2015	Physician's Global Assessment of acne (Investigator's Global Assessment of acne severity) [18]	0 Clear	Residual hyperpigmentation and erythema may be present
		1 Almost clear	A few scattered comedones and a few small papules
		2 Mild	Easily recognizable; less than half the face is involved
		3 Moderate	More than half the face is involved; many comedones, papules, and pustules; nodule may be present
		4 Severe	Entire face is involved; covered with comedones, numerous papules and pustules

James and Tisserand shortly after proposed an alternate grading scheme through their review of acne therapy in 1958 [11]. In addition to the evaluation criteria as in Table 1, this classification was more concerned with the inflammation of the lesions. To illustrate, grade 1 is defined if there are simple and noninflammatory morphologies as dominant lesions, for instance, blackheads, whiteheads, and papules. If inflammation occurs in the affected skin area, grade 2 or higher is defined as described in Table 1.

In 1971 , Burton et al introduced a 6-point scale based on the overall impression of acne from grade 0 to grade 5 [12]

In 1979, Cook et al. devised a method wherein the overall severity of acne is evaluated on a 0 - 8 scale anchored to a photographic standard that illustrates grades 0, 2, 4, 6, and 8 [13]. They devised a system for photographing both sides of a patient's face on a single exposure using a front-surface mirror. Then, independent examiners graded the photographs at the end of the study.

In 1997, Doshi et al. introduced a global acne grading system (GAGS) [14]. This system divided the face, chest, and back into six locations (forehead, each cheek, nose, chin, chest, and upper back). The six locations are graded separately on a 0 - 4 scale depending on the most severe lesion within that location (0 = no lesions, 1 = comedones, 2 = papules, 3 = pustules, and 4 = nodules). The score for each area is the product of the most severe lesion, multiplied by the area factor. These individual scores are then added to obtain the total score. For the total score between 1 and 18, the patient is classified as mild while for the total score between 19 and 30, the patient is classified as moderate. If the total score is between 31 and 38, then the grade is severe, and if more than 39 then it is very severe.

In 2005, Leyden et al collected pretreatment and posttreatment photographs of patients with facial acne vulgaris, then assessed the overall severity of each patient's inflammatory acne before and after treatment and global response to treatment [15]. Overall acne severity was assessed using a modified version of a scale published by Allen and Smith. This assessment rates severity on a 7-point scale in which no acne is grade 0, to grade 6 as severe acne. The panel considered a 1-grade improvement or deterioration on this scale to be clinically meaningful. In addition, an improvement or deterioration of ≥ 2 grades was considered clinically significant. Especially, grades 1, 3, and 5 were used to designate intermediate evaluations.

In 2007, Tan et al developed a comprehensive acne severity scale (CASS) by modifying a preexisting facial acne scale, the Investigator Global Assessment, to include truncal acne [16]. The validity and responsiveness of CASS grades were correlated with Leeds scores at baseline and after 6 months of standard acne treatment. The Investigator Global Assessment, previously applied solely to facial acne, was modified for use at the chest and back as the categories were deemed to be appropriate and applicable to these regions.

In 2011, Dréno et al announced the Global Acne Severity Scale (GEA Scale) which is a 6-point photo-numeric scale with descriptive text [17]. The stage was defined according to a global evaluation of the severity of acne lesions as it is performed by the dermatologist in the office: Grade 2: easily recognizable; Grade 3, more than half of the face is involved and many; Grade 4, entire face and covered;

and Grade 5, highly inflammatory and nodules.

In 2015, Pascoe et al used the Physician Global Assessment (PGA) (or Investigator's Global Assessment of acne severity - IGA) to evaluate disease severity and treatment outcomes in acne [18]. PGA is a 5 or 6-point scoring system used to assess disease severity. It has previously been proposed as a simple, intuitive mechanism to collect clinical outcomes data, but investigation of its use has been limited primarily to clinical trials. In this study, they used the 5-point scale (0 - 4) for acne severity evaluation where 0 is clear and 4 is severe.

When the lesion counting acne assessment method is mentioned, it is first accurately calculated by Witkowski and Simons for determining the severity of acne vulgaris in 1966 [19]. It was ascertained that the number of lesions on each side of the face was almost equivalent, thus, lesions were counted on one side in response to time constraints in a medical visit. The figures of closed comedones, open comedones, papules, pustules, and nodules were noted. In particular, papules and pustules were initially classified as small or large lesions, and "abscesses" were later used to describe nodules or cysts. This method was applied with the acne flow form and the acne questionnaire to evaluate the treatment progress as well as find the causes of acne flares or response failures [20].

Table 2. Lesion counting method

Year	Name of method	Description		
1975	Classification of acne severity on lesion counting [21]	**Grade**	**Comedonal**	**Papulopustular**
		Grade 1	<1 0 comedones	<10 inflammatory lesions
		Grade 2	10 - 25 comedones	10 - 20 inflammatory lesions
		Grade 3	26 - 50 comedones	21 - 30 inflammatory lesions
		Grade 4	>50 comedones	> 30 inflammatory lesions
1991	Pochi et al 's severity grading of inflammatory acne lesions [22]	**Severity**	**Papules/pustules**	**Nodules**
		Mild	Few to several	None
		Moderate	Several to many	Few to several
		Severe	Numerous and/or extensive	Many
2008	Lesion counting scale by Hayashi et al. [23]	**Group**	**Total number of lesions**	
		Mild	0 – 5	
		Moderate	6 – 20	
		Severe	21 – 50	
		Very severe	> 50	

In 1975, a different numerical grading was created by Plewig and Kligman [21]. According to an inflammatory condition, the acne lesions were divided into two groups: Comedonal acne and Papulopustular acne and there are four grades of overall acne severity depending on the number of lesions in each group per half face (Table 2).

In 1991, Pochi et al believed it was important to measure the extent of inflamed and noninflamed lesions besides lesion count. Specifically, noninflammatory lesions consist of open and closed comedones, while inflammatory acne is traditionally characterized by the presence of one or more of the following types of lesions including papules, pustules, nodules, and cysts. It was argued that acne manifested only by noninflammatory lesions can rarely be characterized as severe unless the number, size, and extent of such lesions are so overwhelming as to warrant such a designation [22]. The inflammatory lesions were hence counted to assess the acne severity as described in Table 2.

In 2008, Hayashi et al. used standard photographs and lesion counting to classify acne into four groups. First, they classified acne based on the number of inflammatory eruptions of half-face. Second, they counted the lesions and divided the total number of lesions into four groups. For a total number of lesions < 5, the grade is classified as mild and 6 - 20 as moderate [23]. If the total number of lesions is between 21 and 50, it is in the severe group and more than 50 is very severe. Their judgments on severity grades were then compared with those of an expert

panel of three dermatologists, who evaluated half-face photographs of the same patients.

4. DISCUSSION

Grading is based on a subjective assessment of severity, it includes observing the most prominent lesions, evaluating the presence or absence of inflammation, and assessing the extent of involvement. Thus, there are too many factors to consider. Moreover, according to the 1990 Consensus Conference, it was noted that "one of the more frequently used classification systems, dividing acne into four grades of severity, is overly simplistic" [24]. It is the knowledge that lesion counting is better than grading because the former distinguishes minor variations in treatment response. It allows for the assessment of the treatment's effect on specific lesions and also enables the quantification of different types of lesions and the investigation of acne development. Although it may take longer to count lesions, once the more objective counts are collected, global evaluations may be made on a more solid foundation.

In this research, 9 out of 12 methods are acne grading, and most of the others are lesion counting. Hence, global grading scales outperformed counting scales in the subcategory simplicity of use, similar to the current study [25]; nevertheless, given the scale's overall low performance, there was no indication that one method was superior to another in the appropriateness categories.

We did not mention the multimodal imaging scale in this review because of some high requirements of equipment and its algorithms to evaluate objectively. The multimodal imaging system has a lot of promise for producing reliable clinical outcomes; however, because of its fixed character, it may not be appropriate for any community.

There is a significant demand for two types of acne measurements: one that can be used in the office or clinic setting, is simple to use, takes little time, is accurate, and does not require complicated instrumentation, and another that can be used by clinical investigators as a more sensitive indicator of acne severity. Both approaches would be extremely useful in epidemiology studies and the assessment of medicinal medicines if they were standardized.

5. CONCLUSION

Acne vulgaris is a disease of pilosebaceous unit about which there is much to investigate. This work has contributed to the rating of current scales based on objective quality criteria, revealing the advantages and disadvantages of the method methodology and reporting that underlay most published scales in the process.

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