Investigate the severity of acne vulgaris and identify the bacteria in the pustule

Mai Ba Hoang Anh[1*], Tran Van Khanh[2], Vo Tuong Thao Vy[1], Mai Thi Cam Cat[1], Tran Thi Quynh Trang[1], Le Thi Thuy Nga[3], Nguyen Thi Tra My[1]

(1) Dermatology Department, Hue University of Medicine and Pharmacy, Hue University

(2) Internal medicine residency, Hue University of Medicine and Pharmacy, Hue University

(3) Dermatology Clinic, Hue University of Medicine and Pharmacy Hospital

Abstract

Background: Acne vulgaris is an inflammatory disease of the pilosebaceous unit, especially in adolescents. There are many classifications of the disease severity, and the role of bacteria in the pathogenesis has been confirmed. This article evaluates the severity of acne through the Global Acne Grading System and Investigator's Global Assessment, and the presence of bacteria in the pustule. **Materials and methods:** Cross-sectional descriptive study on 72 patients diagnosed with acne vulgaris from January 2021 to July 2022 at the Dermatology Clinic at Hue University of Medicine and Pharmacy Hospital. Samples were collected from pustules for the bacterial culture. **Results:** For the Global Acne Grading System classification: mild 34.7%, moderate 45.9%, severe 16.7%, and very severe 2.7%. For the Investigator's Global Assessment: almost clear 4.2%, mild 29.2%, moderate 30.5%, severe 22.2%, and very severe 13.9%. Two scales demonstrated the inter-rater reliability. There were 16 out of 30 specimens from pustules with bacterial presence, among them *Staphylococcus aureus* 56.4%, *Staphylococcus epidermidis* 12.5%, Methicillin-Resistant *Staphylococcus aureus* 12.5%, *Staphylococcus coagulase negative* 6.2%; two samples had the co-infection with *Staphylococcus aureus* and *Klebsiella pneumonia*, *Staphylococcus aureus* and *Enterobacter spp.* **Conclusion:** Moderate and mild severity predominate in the GAGS and IGA classifications, and there is a correlation between the two classifications. Five bacteria were found in pustular lesions, of which *Staphylococcus aureus* accounted for most.

***Keywords**: Acne vulgaris, GAGS, IGA, bacteria.*

1. BACKGROUND

Acne vulgaris (AV) is a prevalent disease, related to the sebaceous follicle unit, which affects about 85% of adolescents. Four main factors form lesions including increased sebum production, changes in the keratinization process of the follicular, invasion of *Cutibacterium acnes*, and inflammatory response [1]. In addition, the interaction of multiple factors such as genetics, psychology, and occupation contribute to the formation of acne and worsen the progression of the disease [1], [2].

There are more than 25 different classifications of acne, based on lesion characteristics, quantity, location, and imaging methods. AV lesions include comedones, papules, pustules, nodules, and cysts; deep inflammatory lesions often lead to scarring. AV usually appears in areas of the body that have many sebaceous glands such as the face, chest, upper back, and arms. Image assessment methods through fluorescence imaging, polarization imaging or multispectral imaging help analyze lesions more clearly [3].

Studies have found many bacteria such as *Staphylococcus epidermidis*, *S. aureus, Klebsiella sp., Escherichia coli*, and *S. vitulinus* in AV lesions [4]. This suggests a role for other bacteria, besides *C. acnes*, in the pathogenesis of this disease. We conducted this project to survey the severity grade of AV based on the Global Acne Grading System (GAGS) and the Investigator's Global Assessment (IGA) score, and the presence of bacteria in pustular lesions.

2. MATERIALS AND METHOD

2.1. Materials

72 patients were diagnosed with AV by the following criteria:

- Type of lesions: comedone, papule, pustule, nodule or cyst.
- Location: face (cheeks, forehead, nose, chin, jaw), chest, back.

Patients who attended to participate in this study were under 25 years old and had not received oral or topical medication treatment for a month.

2.2. Methods

Study subject

A cross-sectional descriptive study proceeded

Corresponding Author: Mai Ba Hoang Anh. Email: mbhanh@huemed-univ.edu.vn
DOI: 10.34071/jmp.2024.6.10
Received: 2/1/2024; Accepted: 10/10/2024; Published: 25/12/2024

from January 2021 until July 2022 at the Dermatology Clinic at Hue University of Medicine and Pharmacy Hospital.

Steps to conduct research

Prepare a research form. Select patients who agree to participate in the study. Collect information. Research variables and indicators: age, gender, occupation, age of onset, treatment history, disease severity, and bacterial identification.

The severity of acne vulgaris

The grade of AV according to GAGS has four levels based on the total score, and the level according to IGA is based on the characteristics and number of lesions [3].

Table 1. The severity of acne according to GAGS and IGA

Assess the level according to GAGS (*Global Acne Grading System)*				
Severity (A)	**Location**	**Factor (B)**	**Local score (AxB)**	**Grade**
0 = No lesions 1 = Comedone 2 = Papule 3 = Pustule 4 = Nodule	Forehead	2		Mild: 1-18 Moderate: 19-30 Severe: 31-38 Very severe: >38
	Right cheek	2		
	Left cheek	2		
	Nose	1		
	Chin	1		
	Chest and upper back	3		
			Total score:	

Assess the level according to IGA (*Investigator's Global Assessment)*	
Almost clear	A few comedones or papules
Mild	Several comedones, papules, and pustules
Moderate	Many comedones, pustules and no more than a nodule
Severe	Many comedones, papules, pustules, and several nodules
Very severe	Nodules cover most of the face

Survey for bacterial presence

Pus from the pustular lesion was collected for bacterial culture.

Statistical method

SPSS 20.0 software was used for the analysis and processing of the data

3. RESULTS

3.1. Background characteristics of the study group

Female patients accounted for a higher proportion than males. The percentage of age group 18 - 22 comprised more than the other two age groups. The vast majority of patients were students. The number of patients who had previously been treated for acne was higher than the untreated group. The age of AV onset is highest at 15 years old with 25%, followed by 16 years old with 19.4%, the remaining percentage is from 2.8% to 11.2% (Table 2).

Table 2. Background characteristics of the study (n=72)

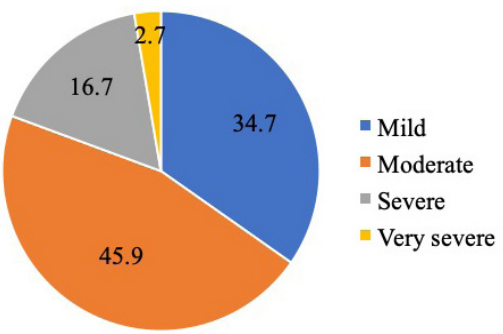
Characteristics		**N**	**%**
Gender	Men	30	41.7
	Women	42	58.3
Age	13 - 17	16	22.2
	18 - 22	37	51.4
	23 - 25	19	26.4

Profession	Pupil	16	22.2
	Student	42	58.3
	Employe	14	19.5
History of AV treatment	Treated	42	58.3
	Untreated	30	41.7
Age of onset	10	4	5.6
	11	6	8.3
	12	6	8.3
	13	8	11.2
	14	7	9.7
	15	18	25
	16	14	19.4
	17	4	5.6
	18	2	2.8
	19	3	4.2

3.2. Severity of Acne vulgaris

3.2.1. Based on Global Acne Grading System (GAGS)

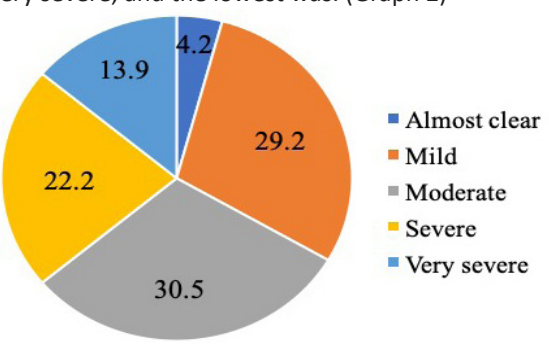
The moderate level of disease occupied the highest rate, followed by mild, severe, and very severe levels (Graph 1).



Graph 1. Severity of AV based on GAGS

3.2.2. Based on the Investigator's Global Assessment (IGA) score

The moderate severity of the disease accounted for the highest percentage with nearly one-third, followed by mild, severe, and very severe, and the lowest was. (Graph 2)



Graph 2. Severity of AV based on IGA

3.2.3. Relating disease severity according to GAGS and IGA

Each GAGS and IGA scale was divided into 3 levels, with a correlation between the two scales (Table 3).

Table 3. Correlation between GAGS and IGA

IGA \ GAGS	Mild		Moderate		Severe - Very severe		Total		p
	N	%	N	%	N	%	N	%	
Almost clear - Mild	15	62.5	9	37.5	0	0	24	100	
Moderate	8	36.4	13	59.1	1	4.5	22	100	<0.05
Severe - Very severe	2	7.7	11	42.3	13	50	26	100	
Total	25	34.7	33	45.8	14	19.5	72	100	

3.3. Identification of bacteria

30 patients had pustular lesions, among them 16 patients had a positive culture (Table 4).

Table 4. Result of bacterial identification

Bacteria	N	%
Staphylococcus aureus	9	56.4
Staphylococcus epidermidis	2	12.5
Methicillin-Resistant *Staphylococcus aureus*	2	12.5
Staphylococcus coagulase negative	1	6.2
Staphylococcus aureus + Klebsiella pneumonia	1	6.2
Staphylococcus aureus + Enterobacter spp	1	6.2
Total	16	100

4. DISCUSSION

Acne vulgaris is a common disease in adolescents, often manifesting on the face, and affecting aesthetics and psychology. In studies, more women than men had AV. Pupils are in this age group so they made up the highest proportion of the group age coming to the clinic. This is consistent with our study as well as other studies [5], [6]. The proportion of patients who have ever been treated is higher than the group that has never been treated. AV is related to increased androgens during puberty. After treatment, if preventive medicine is not used, the lesions of AV will recur and the disease will re-occur. Hence, patients have to return for treatment [7].

There are many ways to assess the severity of acne, which shows a lack of consensus on this issue, no classification can be considered a global standard. They may not be interchangeable because they measure different disease characteristics. Assessing the severity of the disease is essential to evaluate and monitor clinical progression as well as have an appropriate treatment regimen. One of the commonly used methods is lesion counting. Although time-consuming, it can be a more accurate method. If done by a specialist, it will be more reliable [3], [7].

The GAGS classification was first initiated by Doshi and colleagues. This classification is quite detailed, based on the characteristics of non-inflammatory lesions such as comedones and the level of inflammation gradually increasing from papules, pustules, and nodules to calculate a score combining positions on the face, chest and upper back to give the final total score, thereby knowing the severity of the disease [8]. IGA is a method recommended by the FDA based on the number and characteristics of facial lesions, regardless of chest and shoulder locations [9]. Both methods do not take into account scarring or post-inflammatory pigmentation disorders. In our study, the two severity scales have a decreasing scale from moderate, mild, severe, and very severe. However, in the IGA scale, there is also almost clear, so the total level of almost clear and mild is 33.4%, accounting for the highest rate. We divided each scale into three groups to compare and see if there was a relationship (Table 3), consistent with the research of Hadeel Alsulaimani and colleagues [9].

In this study, 30 patients with pustules were tested for bacterial culture, of which 16 samples,

accounting for 53.3%, showed the presence of five bacteria (Table 4). *S. aureus* occupied the highest proportion, presented in 13 samples, among with 2 MRSA, and there was co-infection with *S. aureus* and *K. pneumonia*, *S. aureus* and Enterobacter, the remaining was *Staphylococcus epidermidis* and *Staphylococcus coagulase negative*. *Cutibacterium acnes* found in sebaceous glands and hair follicles contribute to the inflammatory process leading to acne formation. This is ananaerobic bacteria, while the culture medium in our study was aerobic, this may explain the 14 specimens in which no bacteria were found. Research by Nelva Karmila Jusuf and colleagues on the presence of bacteria in acne lesions shows that the majority is *Staphylococcus*; for *C. acnes*, the presence of this bacterium in non-inflammatory and inflammatory lesions was 17.5% and 25%, respectively [4]. The bacteria found may play a role in the pathogenesis of AV. According to Pathatk et al., *C. acnes* and *S. epidermidis* were common bacterial species found in 70% of patients [10]. *S. epidermidis* is a commensal bacterium on the skin that also contributes to the production of lipase factors and delta haemolysin, which can be considered key factors in the formation of inflammatory lesions [11].

5. CONCLUSION

GAGS and IGA are applied to reliably evaluate acne vulgaris, moderate and mild levels predominate over severe and very severe levels. The presence of bacteria in pustules may play na important role in the mechanism of the formation of inflammatory lesions in acne.

REFERENCES

1. Asai Y, Baibergenova A, Dutil M, Humphrey S, Hull P, Lynde C, et al. Management of acne: Canadian clinical practice guideline. CMAJ. 2016;188: 118–126. doi:10.1503/cmaj.140665

2. Abdel-Hafez K, Mahran AM, Hofny ERM, Mohammed KA, Darweesh AM, Aal AA. The impact of acne vulgaris on the quality of life and psychologic status in patients from upper Egypt. Int J Dermatol. 2009;48: 280–285. doi:10.1111/j.1365-4632.2009.03838.x

3. Ramli R, Malik AS, Hani AFM, Jamil A. Acne analysis, grading and computational assessment methods: an overview. Skin Res Technol. 2012;18: 1–14. doi:10.1111/j.1600-0846.2011.00542.x

4. Jusuf NK, Putra IB, Sari L. Differences of Microbiomes Found in Non-Inflammatory and Inflammatory Lesions of Acne Vulgaris. Clin Cosmet Investig Dermatol. 2020;13: 773–780. doi:10.2147/CCID.S272334

5. Trịnh TT, Huỳnh VB, Trần ĐQ. Đặc điểm lâm sàng trên bệnh nhân trứng cá thông thường đến khám và điều trị tại bệnh viện Đại học Y Dược Cần Thơ năm 2018-2019. VMJ. 2021;505. doi:10.51298/vmj.v505i1.1013

6. Tran NKN, Vo TB, Mai BHA, Nguyen TTM, Nguyen TTP, Le TTN. Knowledge - attitude - practice about acne vulgaris and its association among acne patients at dermatology clinic of Hue University of Medicine and Pharphacy Hospital. JMP. 2019; 73–79. doi:10.34071/jmp.2019.1.12

7. Thiboutot DM, Dréno B, Abanmi A, Alexis AF, Araviiskaia E, Barona Cabal MI, et al. Practical management of acne for clinicians: An international consensus from the Global Alliance to Improve Outcomes in Acne. J Am Acad Dermatol. 2018;78: S1-S23.e1. doi:10.1016/j.jaad.2017.09.078

8. Doshi A, Zaheer A, Stiller MJ. A comparison of current acne grading systems and proposal of a novel system. International Journal of Dermatology. 1997;36: 416–418. doi:10.1046/j.1365-4362.1997.00099.x

9. Alsulaimani H, Kokandi A, Khawandanh S, Hamad R. Severity of Acne Vulgaris: Comparison of Two Assessment Methods. Clin Cosmet Investig Dermatol. 2020;13: 711–716. doi:10.2147/CCID.S266320

10. Pathak R, Kasama N, Kumar R, Gautam HK. Staphylococcus epidermidis in human skin microbiome associated with acne: A cause of disease or defence? Research Journal of Biotechnology. 2013;8: 78–82.

11. O'Neill AM, Gallo RL. Host-microbiome interactions and recent progress into understanding the biology of acne vulgaris. Microbiome. 2018;6: 177. doi:10.1186/s40168-018-0558-5