Microbial profile and antibiotic susceptibility of bacteria isolated from patients with hidradenitis suppurativa

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Background: Hidradenitis suppurativa (HS) is a chronic inflammatory skin disease of unknown etiology. There is evidence that bacteria may contribute to initiating the inflammatory response in HS patients. To date, data on bacteria found in HS lesions and their resistance rates are rare.

Methods: The results of bacterial cultures and antibiotic susceptibility of the isolated bacteria obtained from HS lesions of 26 patients at our dermatology department were analyzed.

Results: A total of 50 samples were collected from HS patients. Of the 50 lesional samples, 46 were culture-positive. The 50 lesional samples yielded 61 isolates. The most common isolated bacteria were *Staphylococcus aureus*, *Diphtheroid*, and *Escherichia coli*. Most of the isolates were resistant to penicillin G, followed by erythromycin, clindamycin and ampicillin. The lowest resistant rates were observed for ceftriaxone, imipenem, amikacin, tetracycline, and vancomycin.

Conclusions: Due to the low susceptibility rate and anti-inflammatory properties, tetracycline may represent as an effective antibiotic agent for therapy in HS patients.

Keywords: hidradenitis suppurativa, antibiotic, susceptibility, bacteria

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INTRODUCTION

Hidradenitis suppurativa (HS) is a chronic inflammatory skin disease which is manifested by recurrent abscesses, sinus tracts and scarring [1]. The prevalence of HS is estimated to be as high as 1% to 2% in the general population and it is among the most distressing conditions observed in dermatology [2].

Hidradenitis suppurativa usually begins after puberty and the clinical severity of the disease varies among patients. Most patients have a mild form of the disease, which manifests as painful large nodules. These nodules can resolve spontaneously, persist as "silent" ones, or lead to abscess formation. In contrast, patients with severe HS have chronic, painful, suppurating lesions that persist for a long time. Chronic lesions usually involve multiple areas connected by inflamed sinus tracts surrounded by hypertrophic scars [3].

Although several hypotheses on the disease pathogenesis have been presented, the main theory is hair follicle plugging, and in contrast to acne, the sebaceous glands appear reduced or absent in HS [4]. Histologically, HS appears to be characterized by hyper-keratinization of the hair follicle with an immediate hair follicle occlusion and subsequent follicular dilatation and perifollicular inflammation [5].

Hidradenitis suppurativa is currently thought of as being a sterile inflammation, but bacteria are suspected of playing a role in the disease process [6]. Consistent findings of different bacteria specimens, such as gram-positive cocci and gram-positive rods including *Staphylococcus aureus* (*S. aureus*), coagulase-negative *staphylococci* (CoNS)

and *Corynebacterium* species have been found in HS lesions [7]. When bacteria are found in HS lesions, they are considered by some as overgrowth or contaminants from skin bacterial residents or occasionally as a result of secondary infection [8]. It is suggested that bacteria may play a role through immune-mediated mechanisms of inflammation in association with a dysregulated immune response in the hair follicles [6]. Thus, a reduction of bacteria in HS lesions may lead to a decreased grade of inflammation and clinical improvement in HS patients.

Antibiotic therapy is, however, widely used as a prominent form of treatment for HS [6]. In order to choose an effective antibiotic regimen, knowledge about resistance patterns is advantageous. However, to date, data on the resistance rates of bacteria found in HS lesions are rare.

Thus, we aimed to evaluate the microbial profile in bacterial cultures obtained from inflammatory HS lesions and to analyze the susceptibility pattern of the isolated bacteria.

PARTICIPANTS AND METHODS

Participants and study design

We retrospectively evaluated the results of bacterial cultures and susceptibility patterns of the isolated bacteria obtained from 26 patients with HS at Department of Dermatology, Faghihi Hospital, Shiraz, Iran. The diagnosis of HS was made based on the presence of well-established criteria, including a history of chronic inflammation for at least 1 year, recurring at the same place in apocrine-bearing sites [9]. Exclusion criteria included the administration of systemic or topical antibiotic therapy or immunosuppressive medications for at least 4 weeks prior to sampling.

Clinical assessment

Specimens were obtained from HS lesions by sterile swab, after cleaning the area with povidone-iodine. The collected material was transported using sterile culture tube to the laboratory in a medium for aerobic bacteria. The material was processed according to standard procedures at the Department of Microbiology of Shahid Faghihi Hospital,Shiraz,Iran.

Identification and confirmation of the isolated bacteria were performed using biochemical methods [10]. Biochemical characterization was done by performing the oxidase reaction, pigmentation or mucoidity, growth at 37°C, and growth on blood agar.

All the isolates were tested using cation-adjusted blood agar (Himedia, India). Results were interpreted according to the clinical and laboratory standards institute (CLSI) guideline [11].

Statistical methods

Categorical data are presented as numbers with percentages. The data were analyzed using SPSS version 19.

RESULTS

Of the 26 patients, 19 (73.1%) were males and 7 (26.9%) were females. The mean age of the patients was 34.23 ± 11.93 (mean ± SD).

A total of 50 samples were collected from HS patients. Of the 50 lesional samples, 46 (92%) were culture-positive. Of the 46 culture-positive samples, 15 (32.6%) showed poly-microbial growth (defined as the number of isolates >1 per sample).

The samples were obtained from the axilla, groin, scalp, neck, buttock, back, intermammary and perineal regions. Our results showed that poly-microbial growth was more frequent in samples obtained from the axilla (46.7%).

The 50 lesional samples yielded 61 isolates. Of the 61 isolates, 48 (78.7%) were Gram-positive and 13 (21.3%) were Gram-negative. The most common isolated bacteria were *S. aureus* (50.8%), *Diphtheroid* (9.8%), and *Escherichia coli (E.coli*) (8.2%). The frequency of other isolated bacteria is shown in Table 1.

Next, we analyzed the localizations of the three common bacterial isolates. *S. aureus* (48.4%) and *Diphtheroid* (50%) were more frequent in cultures obtained from the axilla. *E.coli* was more frequent in axilla (40%) and groin (40%).

Of the 61 isolates, most of them were resistant to penicillin G (34/61, 55.7%), followed by erythromycin (32/61, 52.5%), clindamycin (29/61, 47.5%) and ampicillin (28/61, 45.9%).

The lowest resistant rates were observed for ceftriaxone (1/61, 1.6%), imipenem (2/61, 3.2%),

Table 1. Frequency of bacteria species isolated from HS lesions (n=61)

Bacterial isolates	Total, n (%)
Staphylococcus aureus	31 (50.8%)
Diphtheroids	6 (9.8%)
E.coli	5 (8.2%)
Enterococcus	4 (6.6%)
Citrobacter	4 (6.6%)
Staphylococcus epidermidis	4 (6.6%)
Proteus	3 (4.9%)
Coagulase negative staphylococcus	2 (3.3%)
Acinetobacter	1 (1.6%)
Streptococcus	1 (1.6%)

Table 2. Antimicrobial resistance pattern of 61 isolates

Antimicrobial agents tested	Resistance rate among all isolates
Penicillin	34 (55.74%)
Erythromycin	32 (52.46%)
Clindamycin	29 (47.54%)
Ampicillin	28 (45.90%)
Amoxicillin	19 (31.15%)
Ciprofloxacin	17 (27.87%)
Cotrimoxazole	13 (21.31%)
Rifampin	12 (19.67%)
Cephalothin	11 (18.03%)
Ampicillin Sulbactam	11 (18.03%)
Cefazolin	8 (13.11%)
Cefoxitin	8 (13.11%)
Chloramphenicol	6 (0.09%)
Gentamicin	5 (0.08%)
Cefepime	5 (0.08%)
Methicillin	5 (0.08%)
Ceftazidime	3 (0.05%)
Piperacillin	3 (0.05%)
Vancomycin	2 (0.03%)
Imipenem	2 (0.03%)
Amikacin	2 (0.03%)
Tetracycline	2 (0.03%)
Ceftriaxone	1 (0.02%)

amikacin (2/61, 3.2%), tetracycline (2/61, 3.2%) and vancomycin (2/61, 3.2%). Results of antibiotic resistance patterns of the isolated bacteria are detailed in Table 2.

DISCUSSION

Bacteria have an important role in initiating the inflammation in HS patients by presenting targets for the immune system. Bacterial lipopolysaccharide (LPS) present targets for toll-like receptors. After recognition, keratinocytes and macrophages are activated and release various pro-inflammatory cytokines and chemokines. Consequently, if bacterial species persist, an increasing amount of immune cells are recruited by chemotaxis. These cells exacerbate the chronic inflammation observed in HS [12,13].

As mentioned above, bacteria play an important role in initiating and maintaining the inflammatory reaction in HS.

Our results showed that bacterial growth was present in 92% and poly-microbial growth in 32.6% of the samples. *S. aureus* was the most commonly isolated bacteria, followed by *Diphtheroid*, and *E.coli*. The topographical distribution of these 3 common bacterial isolates showed that *S. aureus* and *Diphtheroid* were significantly more frequent in cultures obtained from the axillae. In addition, *E. coli* was significantly more frequent in the groin and axilla. Poly-microbial growth was significantly more common in samples obtained from the axillary region.

Lapins et al. used carbon dioxide laser surgery to obtain samples from different levels of HS lesions. They found that *S. aureus* and *CoNS* were the most frequently isolated species [8]. Jemec et al. performed study on 41 HS patients. They suggested that 49% of all active HS lesions were culture-positive and the predominant bacteria were *S. aureus* and *Staphylococcus epidermidis* (*S. epidermidis*) [14]. Brook and Frazier undertook a retrospective analysis of the microbiological and clinical data of 17 specimens obtained from axillary HS lesions. The most frequently isolated aerobic bacteria were *S. aureus*, *Streptococcus pyogenes* and *Pseudomonas aeruginosa* (*P. aeruginosa*). In addition, they found poly-microbial growth in the majority of HS lesions [15].

As mentioned above, there is evidence that bacteria play an important role in initiating and maintaining the inflammatory reaction in HS; thus, antibiotic therapy would be beneficial to reduce the bacterial colonization and subsequent inflammation in HS patients. Many studies suggest that the combined therapy with rifampicin and clindamycin would be effective in HS patients [16,17]. In clinical practice, the prescription of various antibiotic agents is common in most HS patients. This raises a question about the resistance and susceptibility patterns of bacterial pathogens found in HS lesions since the knowledge about resistance patterns is advantageous for effective antibiotic therapy. However, to date, only a few studies have addressed this significant issue [18,19].

Our analyses of bacterial susceptibility patterns revealed that penicillin G, erythromycin,

clindamycin, and ampicillin were among the least effective antibiotic agents for HS. The lowest resistant rates were observed for ceftriaxone, followed by imipenem, amikacin, tetracycline and vancomycin.

Katoulis et al. performed a study on 22 HS patients. They found that the predominant species were *CoNS* and *Proteus mirabilis (P. mirabilis*), which were found to be resistant to tetracycline, clindamycin and erythromycin. Hessam et al. evaluated the results of bacterial cultures and susceptibility patterns of the isolated bacteria obtained from 113 HS patients. The most common isolated bacteria were *CoNS* and *S. aureus*, followed by *P. mirabilis* and *E.coli*. Their analyses of bacterial susceptibility patterns revealed that penicillin G and ampicillin, together with erythromycin and clindamycin, were among the least effective antibiotic agents for HS. They observed the lowest resistant rates for fosfomycin, imipenem, moxifloxacin, ciprofloxacin, levofloxacin and cotrimoxazole.

Among the antibiotic agents with low resistance rates, we consider tetracycline as the most effective antibiotic agent for HS patients. Tetracycline can be administered orally. Furthermore, our findings revealed that tetracycline had a low resistance rate of 3.2%. There is also strong evidence showing that, in addition to its antimicrobial properties, tetracycline also has anti-inflammatory effects [20].

An important limitation of our study is the limited number of the patients. Further studies with more patients as well as the use of the most appropriate sampling method are needed to draw more definitive conclusions.

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