ORIGINAL ARTICLE

Bacterial cultures, rapid strep test, and antibiotic treatment in infected hard-to-heal ulcers in primary care

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Abstract

Objective. In-depth studies on antibiotic treatment for patients with hard-to-heal ulcers in primary care are lacking. The present study was undertaken to update the bacteriological spectrum for this patient group and to investigate antibiotic treatment. A further aim was to investigate the potential of a rapid strep test to find group A streptococci (GAS) causing ulcer infection. **Design.** A prospective study from August 2009 to August 2010. **Setting.** Blekinge Wound Healing Center. **Subjects.** Patients with clinical signs of infected hard-to-heal ulcers of any etiology. **Main outcome measures.** A bacterial culture and a rapid strep test were taken from every ulcer to capture the bacteriological spectrum. Antibiotic treatment before and during the study period was measured. **Results.** Forty-one patients with 49 infected ulcers were recruited. *Staphylococcus aureus*, found in 68.8% of all cultures, was the most observed species. Group G streptococci (GGS) were found in 12.5%. GAS was found in one case where the rapid strep test was positive. *Staphylococcus aureus* was found in three patients out of four with clinical signs of erysipelas. Some 59% of the patients were treated with antibiotics before the study period compared with 44% during the study period. **Conclusion.** Antibiotic treatment was largely reduced because of structured wound management. The current bacteriological spectrum showed high rates of GGS and erysipelas caused by *Staphylococcus aureus*. The rapid strep test was found useful in identifying GAS but we would not recommend its use in the clinical setting due to the low rate of GAS in this patient group.

Key Words: *Bacteriological spectrum, continuity of medical care, group A streptococci (GAS), Group G streptococci (GGS), Staphylococcus aureus, Pseudomonas aeruginosa, ulcer infection*

Introduction

In primary care, too many patients with hard-to-heal ulcers are treated with per oral antibiotics (68–78%) [1–3] because of problems of clinically assessing an ulcer infection [4,5] and because of the lack of continuity of medical care [6]. Wound management is also time and money consuming and a source of reduced quality of life for the patients affected [1,7,8].

One important area of wound management is the treatment of ulcer infections because the majority of hard-to-heal ulcers are contaminated or colonized by bacteria. In most cases, these bacteria are *Staphylococcus aureus*, which usually do not affect ulcer healing [9–11]. When a local infection is present, treatment with suitable topical antimicrobial dressings and more frequent dressing changes by a specialist nurse are required [4,5,12]. If there are persisting signs of infection, a bacterial culture is

usually taken to help assess the ulcer infection. If the clinical diagnosis of erysipelas is assessed, the patient is provided with per oral antibiotic treatment. β -hemolytic streptococcus group A (GAS) is said to be the predominant bacteria in erysipelas, which is why a culture is not considered necessary [13,14]. A venous leg ulcer is often the locus minoris resistentiae for erysipelas [13,14].

The present study was undertaken to update the bacteriological spectrum for patients with hard-to-heal ulcers in primary care and to investigate antibiotic treatment.

A further aim was to investigate the potential of using a rapid strep test to find ulcer infections caused by GAS.

Material and methods

This prospective study was carried out between 17 August 2009 and 31 August 2010. The setting was

- It has been noted that prescription of antibiotics for treating patients with hard-to-heal ulcers in primary care is too high.
- The current bacteriological spectrum showed high rates of Group G streptococci (GGS) and erysipelas caused by *Staphylococcus aureus*.
- The rapid strep test was found useful in identifying Group A streptococci (GAS) but we would not recommend it in the clinical setting.
- Antibiotic treatment for this patient group was largely reduced because of structured wound management.

Blekinge Wound Healing Center (BWHC), which is a primary care-based specialist center for the county of Blekinge (approximately 150 000 inhabitants).

We consecutively recruited patients with clinical signs of ulcer infection. The gender and age of the patient, ulcer etiology, and duration were recorded following the routines of the Register of Ulcer Treatment (RUT), the Swedish National Quality Register for hard-to-heal ulcers [15]. Ulcer size was measured with a digital planimeter. If the patient had more than one ulcer, the largest ulcer was included in the study, following praxis in studies on leg ulcers [9].

All patients received oral and written information and gave informed consent. A bacterial culture was taken from the rinsed ulcer bed with a medical swab, following local laboratory routines. The results from the bacterial culture came back in between three and five days. In cases where the test showed one or more bacteria, which were considered to have caused the infection, the patient received a prescription for antibiotics.

A rapid strep test was also taken with a medical swab from the same area of the ulcer. The test was carried out in the examination room and the result was available within five minutes. In the case where the rapid strep test showed GAS, the patient received a prescription for per oral antibiotics, penicillin V, 1 gram three times a day for 10 days, following the national recommendations [12].

The rapid strep test, which is considered an easy and accurate test [16], is used on a daily basis in every health care center in Sweden to identify tonsillitis caused by GAS.

We did not take any culture to detect MRSA, having no clinical indication of this infection being present; there is a very low incidence of MRSA in hard-to-heal ulcers in the county of Blekinge (<1%) [personal communication].

Ethics approval

The regional ethics committee in Lund considered the study to be a valuable quality improvement study, so no further ethical consideration needed to be made (Lund 2009/6).

Results

Patient characteristics

During the study period 482 patients were treated at BWHC. Ulcer infection was suspected in 8.5%, based on clinical grounds, i.e. increased exudates, pain, swollen edges, edema, or ulcer size. We did not verify the infection with a C-reactive protein (CRP) but followed the consensus that the diagnosis of ulcer infection is a clinical judgment [4].

Forty-one patients were included in the study: 26 women (63%) and 15 men (37%), with a mean age of 72.7 years (median 72 years), and age ranging from 38 to 97 years.

The mean ulcer duration was 36 weeks (median 24 weeks; range 1–260 weeks) and the mean ulcer size was 11.0 cm², ranging from 0.05 cm² to 144.2 cm² (median 3.5 cm²). Slightly more than half of the patients had one ulcer (51%), while the remaining patients had between two and eight ulcers.

The ulcer of five patients deteriorated to such an extent that another culture was taken on one or two occasions, leaving 49 hard-to-heal ulcers to be included in the study.

The etiology of the 49 ulcers included venous ulcers (31%), venous-arterial ulcers (16%), traumatic ulcers (16%), arterial ulcers (13%), hydrostatic-traumatic ulcers (8%), diabetic foot ulcers (6%), pressure ulcers (6%), and one patient with osteitis and another with a vasculitic ulcer.

Results of the bacterial cultures

In one case, the swab did not reach the laboratory in time so we excluded this bacterial culture, leaving 48 cultures to document (Figure 1).

As shown in Figure 1, 40% of the remaining 48 cultures showed only one species, while 60% of the cultures showed two or more bacteria. *Staphylococcus aureus* was the most frequently observed species, whether the culture contained one species or more, and was found in 68.8% of all cultures. GAS was found in one patient (2%). *Pseudomonas aeruginosa* was found in 14.6%, where the median ulcer size was larger compared with the median size of all ulcers, 13.1 cm² and 3.5 cm² respectively. Infections with β -hemolytic streptococcus group G (GGS) were seen in four patients, of whom two patients had

Figure 1. Results from 48 bacterial cultures presenting a total of 21 different species. Note: The figure shows the total distribution of each species.

recurrent infections. Thus GGS was observed in six cultures (12.5%). One culture did not show any bacteria.

Resistance pattern of Staphylococcus aureus

All bacterial cultures with *Staphylococcus aureus* showed fucidin-sensitive strains.

Bacterial cultures and the rapid strep test

GAS was found in one culture and the result from the rapid strep test was the same. In all other cases, the rapid strep test was negative for GAS.

Antibiotic treatment before the study

Before entering the study, 24 patients (59%) had received antibiotic treatment (1–3 times) for the ulcer included in the study.

Antibiotic treatment during the study

During the study, 44% of the patients (18/41) were treated with per oral antibiotics. Four patients had GGS infection; one had GAS infection. Four patients had erysipelas, where *Staphylococcus aureus* was the bacterial agent in three cases, and one patient, who had recently suffered from sepsis, was reinfected by *Staphylococcus aureus*. Two patients had diabetic foot ulcers and one patient had a vasculitic ulcer. One patient received antibiotics because of a massive infection by *Pseudomonas aeruginosa* and the

remaining four patients, who had a predominance of *Staphylococcus aureus*, received antibiotics because of their general state of health.

Deterioration/recurrence of ulcer infection

During the study period, the ulcer infection deteriorated in five patients, making antibiotic therapy necessary. The predominant species were *Staphylococcus aureus* alone or in combination with GGS.

Of the four patients (two women and two men) with GGS infection, two patients had a recurrence and were treated twice with antibiotics. The mean age of the patients with GGS infection was 80 years compared with 72.7 years for the total patient population in the study.

Discussion

Summary of main findings

The most remarkable finding in this study is the low rate of antibiotic treatment (44%) in the patient group studied, compared with earlier findings of 68–78% [1,3].

One explanation could be the organization of the BWHC with a stable doctor–patient relationship. Previous research has shown the advantages of a structured organization in leg ulcer care [17,18], and Petursson found that lack of continuity of medical care was the main reason that general practitioners prescribe antibiotics in a “non-pharmacological” manner [6].

Our study further demonstrates a shift in the bacteriological spectrum for patients with hard-to-heal ulcers in primary care, with a higher rate of GGS (12.5%) compared with earlier research results of 3–4% [11,19]. We also noted, in accordance with earlier researchers, recurrence of GGS infection [20] and that GGS patients were older. The male predominance and indication of underlying disease such as malignancy found among patients afflicted with GGS infection [21] was not reflected in our material.

We found *Staphylococcus aureus* in three of four patients with clinical signs of erysipelas. GAS has earlier been reported as the bacteria most likely to cause erysipelas but *Staphylococcus aureus* can also cause erysipelas [13].

The rapid strep test was found useful in identifying GAS but because of the low rate of GAS found in this patient group we would not recommend using it in the clinical setting.

We noted *Pseudomonas aeruginosa* in 14.6% of the cases compared with 33.6% found by other researchers, who considered *Pseudomonas aeruginosa* to be a major player in biofilms on wounds because of the increasing use of tap water for wound cleansing in Germany, where the tap water does not contain as much antiseptic chlorine as in other countries [11].

The polymicrobial flora found in this study is in accordance with findings of earlier research [9,10] in which *Staphylococcus aureus* was the most observed species in 41%–88% [9–11] compared with our findings of 68.8%.

Researchers have observed increasing fucidic acid-resistant strains in cultures with *Staphylococcus aureus* (5–50%), underscoring that this increase might lead to failure of topical therapy in primary care [22,23]. All cultures with *Staphylococcus aureus* in our study were fucidin sensitive, possibly due to the strict guidelines of the Blekinge Wound Management Group not to use fucidin as a topical treatment for hard-to-heal ulcers.

Strengths and weaknesses

The inappropriate use of antibiotics is associated with increased antibiotic resistance in the community [24]. MRSA is the greatest threat in ulcer infection worldwide [25], and a study involving emergency departments in the USA found that nearly 60% of isolates from cutaneous infections were caused by MRSA [25]. We did not take any specific culture to detect MRSA, having no clinical indication of this particular infection. The very low incidence of MRSA in hard-to-heal ulcers in the county of Blekinge (<1% in 2010 and 2011) accounted for this decision. We consider the lack of information on MRSA to be a weakness of this study.

The strength of this study is the focus on patients in primary care. The study gives a picture of the complexity of wound management and it highlights the importance of assessing an ulcer infection using bacterial cultures “when needed” to make the right decision before prescribing antibiotics.

Implications for clinicians

We found that antibiotic treatment had been given to the majority of patients before they entered the study. Like previous researchers, we noted that erysipelas was caused by *Staphylococcus aureus*, which may lead to difficult therapeutic decisions [13,14].

Effective and timely diagnosis with treatment appropriate to the cause and condition of the ulcer, along with active measures to avoid the incidence of complications, could have a major impact on both costs and patients’ quality of life [8]. One practical and easy tool is the structured strategy involving continuity of medical care, found in the National Quality Register RUT (Register of Ulcer Treatment), used nationwide in Sweden [15].

Implications for further research

Several aspects of this study deserve further investigation, which includes a larger study to confirm the shift in the bacterial spectrum present, including cultures to detect MRSA.

A recent report showed that “ β -hemolytic streptococci of groups other than A and B (NABS) are increasingly recognized” as causes of clinically significant disease in the USA [26].

We agree with Broyles et al. that the classification and identification of these β -hemolytic streptococci are not widely understood, especially in the clinical setting [26], which is why further studies should be initiated in this field.

The results of this study may also be of interest for the design of future clinical studies aimed at investigating the role of a structured organization with continuity of medical care for patients with hard-to-heal ulcers in primary care.

Statement on financial support

The study was partly funded by Blekinge County Council and the Committee of the Council of Sciences in Blekinge County.

Declaration of interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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