

# Analysis of Antibiotic Susceptibility and Resistance of Leg Ulcer Bacterial Flora in Patients Hospitalized at Dermatology Department, Poznan University Hospital

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**SUMMARY** Effective treatment of frequently infected, poorly healing wounds such as leg ulcers due to chronic venous insufficiency poses a major clinical problem. Antibiotic resistance in dermatology patients, especially those with non-healing leg ulcers, is a widespread phenomenon. Various antibiotics, mainly broad-spectrum agents, are frequently and sometimes inappropriately prescribed, which often leads to the selection of antibiotic-resistant bacteria strains. The aim of this study was to analyze antibiotic susceptibility and resistance of bacterial isolates cultured from leg ulcers. Wound swabs were obtained from patients admitted to Dermatology Department, Poznań University of Medical Sciences, during the 1998-2002 period. Bacteriologic diagnosis of 175 wound swabs was performed in compliance with compulsory laboratory methods. The analysis yielded 173 positive results, predominated by *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Enterococcus faecalis*, *Proteus mirabilis* and *Escherichia coli*. Bacterial isolates were evaluated for resistance to commonly used antibiotics, taking into consideration the presence of methicillin resistant *Staphylococcus aureus* strains. Antibiotic resistance profiles were compared between the years 1998 and 2002, with detailed account of clinical characteristics and history of leg ulcers disease. The study pointed to an increasing tendency of antibiotic resistance in the study group of patients.

**KEY WORDS** leg ulcers, bacterial antibiotic resistance

## INTRODUCTION

Antibiotic resistance has become an increasing problem in modern medicine. The importance of this dangerous situation is nowadays also often recognized in dermatology. This alarming problem is thought to be due to the tendency of uncontrolled utilization of broad-spectrum antibiotics. Various publications indicate a steadily growing number of antibiotic resistant bacterial cultures. The problem

has also been observed in dermatology inpatients (1-3). Chronic wounds such as venous leg ulcers are the cause of morbidity and impaired quality of life in these patients. Non-healing leg ulcers are very often difficult to treat, and pose a recurrent medical and social problem. Therefore, antibiotic therapy is frequently prescribed in leg ulcers patients without either clinical signs of infection or indications for such treatment (1,4,5).

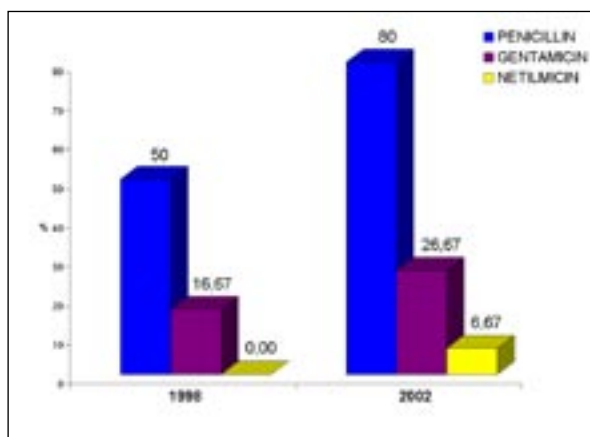
In the present retrospective study, we analyzed the tendency of antibiotic resistance in the bacteria cultured from leg ulcers.

## MATERIAL AND METHODS

Microbiological analysis of wound bacterial cultures was performed in leg ulcer patients hospitalized at Dermatology Department, Poznań University of Medical Sciences, from 1998 till 2002. Microbiological examination of wound swab samples was performed at Laboratory of Bacteriology, Clinical Hospital No. 2 in Poznań. A total of 175 wound swabs were collected from patients aged 34-93 prior to any antimicrobial therapy. Columbia agar with 5% sheep blood, Chapman medium, Sabouraud medium with antibacterial agent, medium for gram-negative bacteria culture, coccosal medium and enriched broth were inoculated for isolation of aerobic bacteria, with incubation at 37° C for 48 h. For anaerobes, isolation specimens were plated onto Columbia agar with 5% sheep blood, selective medium for anaerobic gram-negative bacteria and multiplying broth. The plate media were incubated at 37° C in anaerobic conditions. The identification and susceptibility tests were performed by use of the computer ATB Plus bioMerieux method.

## RESULTS

Out of 175 wound swabs, 173 yielded positive results with the cultures predominated by *Staphylococcus aureus* (56.57%), followed by *Pseudomonas aeruginosa* (37.14%), *Enterococcus faecalis* (22.29%), *Proteus mirabilis* (13.71%), *Escherichia coli* (12.57%) and *Candida* spp. (6.86%). The tendency of antibiotic resistance over the observation period was assessed by data comparison accord-



**Figure 1.** The increasing tendency of methicillin-sensitive *Staphylococcus aureus* (MSSA) antibiotic resistance.

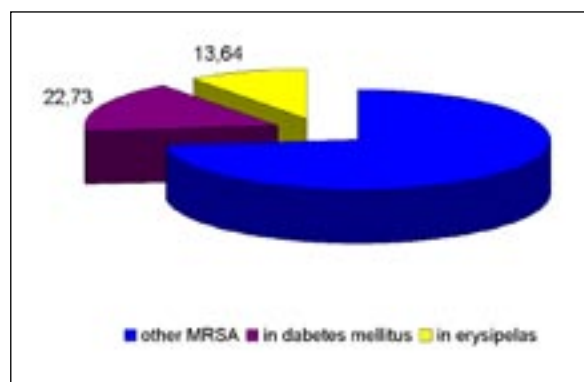
ing to years. Results are presented for each of the predominant bacteria in separate.

### Methicillin-sensitive *Staphylococcus aureus* (MSSA)

MSSA was the most common isolate. An increase in MSSA antibiotic resistance from 1998 till 2002 was recorded for penicillin (from 50% to 80%), gentamicin (from 16.67% to 26.67%), and netilmicin (from 0% to 6.67%) (Fig. 1).

### Methicillin-resistant *Staphylococcus aureus* (MRSA)

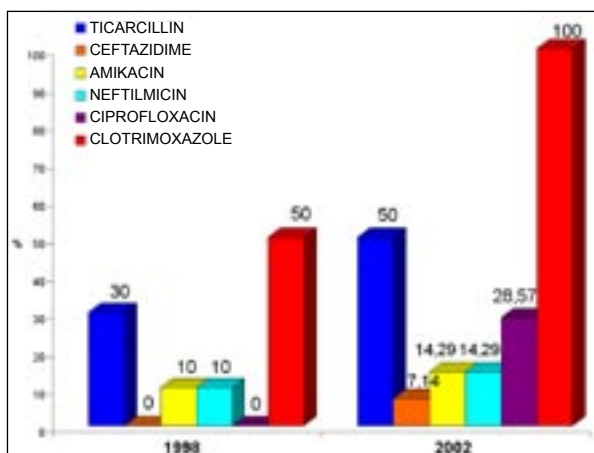
All MRSA isolates were resistant to penicillin, oxacillin, tetracycline and ampicillin with sulbactam. Comparison of data on 1998 and 2002 revealed an increase in resistance to gentamicin (from 57.14% to 80%), erythromycin (from 71.43% to 80%), ciprofloxacin (from 57.14 to 60%) and clotrimoxazole (from 28.57% to 60%). The analysis showed that all cultured MRSA were sensitive to rifampicin, vancomycin and teicoplanin. MRSA strains were also isolated from patients with concomitant diseases such as diabetes mellitus (22.73%) and erysipelas (13.64%) (Fig. 2). Forty-one per cent of MRSA cases were cultured from leg ulcers non-healing for ten or more years.



**Figure 2.** The methicillin-resistant *Staphylococcus aureus* (MRSA) cultured from patients with concomitant diseases.

### *Pseudomonas aeruginosa*

This microorganism was among those showing most rapid rate increase. Moreover, antibiotic resistance to many agents such as ticarcillin, ceftazidime, amikacin, netilmicin, ciprofloxacin and clotrimoxazole was observed (Fig. 3). *Pseudomonas aeruginosa* showed a 100% sensitivity to imipenem in 1998, and only 93% sensitivity in 2002, which was due to one culture of intermediate susceptibility.



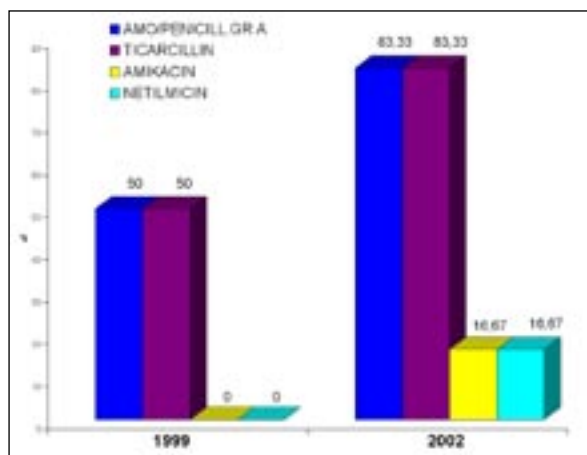
**Figure 3.** The increase of *Pseudomonas aeruginosa* antibiotic resistance between 1998 and 2002.

### *Enterococcus faecalis*

The most pronounced changes in antibiograms were recorded for streptomycin. In 1998, all strains were sensitive to this antibiotic, whereas in 2002, 30.77% of isolates were resistant to it.

### *Escherichia coli*

From 1999 till 2002, this microorganism showed an increase in antibiotic resistance to group A penicillins (from 50% to 80%), amoxiclav (from 0% to 33.33%), and ticarcillin (from 50% to 83.33%). Data also showed an alarming increase of *Escherichia coli* resistance to amikacin and netilmicin (from 0% to 16.67% both) (Fig. 4).



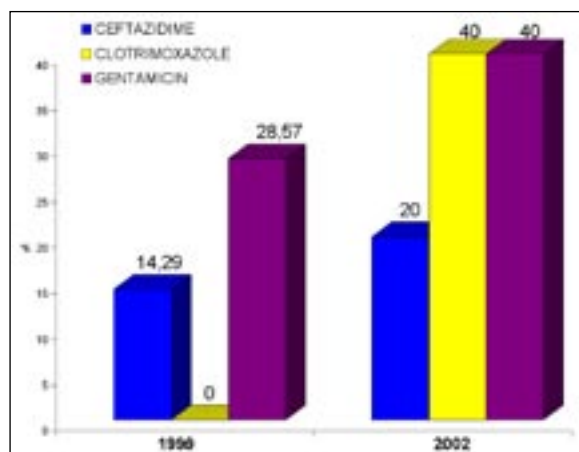
**Figure 4.** The alarming increase of *Escherichia coli* antibiotic resistance.

### *Proteus mirabilis*

An increasing resistance was observed to ceftazidime (14.29% to 20%), gentamicin (from

28.57% to 40%) and clotrimoxazole (from 0% to 40%) (Fig. 5).

The increasing number of cultured bacteria resistant to antibiotics corresponded to the rising incidence of *Candida* spp. isolation (from 2.78% in 2000 to 12.12% in 2002).



**Figure 5.** The increasing tendency of *Proteus mirabilis* antibiotic resistance.

## DISCUSSION

Analysis of the presented results may lead to serious concern about the increasing bacterial resistance to antibiotics. These data are similar to those reported by other authors (1-4,6). Comparison of antibiotic susceptibility of the bacteria cultured from leg ulcers between 1998 and 2002 revealed an increasing tendency of antibiotic resistance. The significant increase in the incidence of bacteria isolation paralleled the increase in their antibiotic resistance. The situation is additionally complicated considering the fact that most of the leg ulcers swabs produced polymicrobial cultures. The widely used antibiotics such as penicillin, gentamicin, netilmicin, ciprofloxacin, clotrimoxazole, ceftazidime, etc., are very often of little benefit because of bacterial resistance.

Bacterial resistance may be innate or acquired. Probably both types are equally important in this context. Moreover, the well known problem of antibiotic resistant bacterial selection is also present in the treatment of infections after occasional or repeated antibiotic therapy. Inadequate duration or dosage of overused antibiotic therapy may also favor antibiotic resistance (2,7).

MRSA has been recognized as a common bacterium found in hospitals. In our study, MRSA strains were cultured in 12.57% of leg ulcer swabs, mainly from patients with non-healing or recurrent ulcers. Patients with the presence of MRSA

in cultures are the main sources of nosocomial infections. Among risk factors for the acquisition and selection of MRSA, some authors include prolonged hospitalization, frequent and extensive use of broad-spectrum antibiotics, and presence of chronic infected ulcers, decubiti and prosthetic intravascular devices (6,8,9). On the other hand, infected ulcers may not only become a serious and dangerous source of nosocomial infections but chronic wounds may also be colonized with nosocomial bacterial strains causing systemic complications in elderly patients with impaired immunity system. Leg ulcers as chronic, non-healing, recurrent wounds pose a major medical problem. The use of broad-spectrum antibiotics in the treatment of leg ulcers is common. However, antibiotic therapy of leg ulcers is frequently of little benefit because of poor penetration of antibiotic into the wound due to impaired vascularization or presence of antibiotic resistant bacteria. Local antibiotic treatment is thought to provoke resistance of leg ulcer bacteria (4,5). Some publications point out that prolonged antibiotic therapy has no effect on ulcer healing even if it reduces pathogenic infection (6,10). In contrast, it has been suggested that antibiotic treatment decreases the incidence of amputations in patients with neuroischemic ulcers (6,11).

Many authors emphasize that clinically infected wounds with the signs of secondary infection, characterized by increased pain or sudden onset of pain, spreading erythema, swelling, cellulitis, purulent exudation and odor are the only therapeutic indication for antibiotic treatment. Others do not agree with this point of view (5,6,10,12-14).

The increasing incidence of antibiotic resistant bacteria should be recognized as a problem of growing importance in dermatology.

In the light of the increasing antibiotic resistance presented, the question of antibiotic administration in venous leg ulcers is of topical interest. There is the need of interdisciplinary and international discussion taking in consideration both local trends and possible solutions.

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