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LETTER

# Atypical Microbial Isolates from Infected Diabetic Foot Ulcers: A Case Series from Greece

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## To the Editor

Diabetic foot infections are a growing health problem worldwide, increasing morbidity and causing a large number of non-traumatic lower-extremity amputations [1-3]. Cultures (ideally tissue, but more frequently swab or aspiration) are a useful guide to antibiotic treatment [1, 2]. The commonest Gram-positive pathogen is *Staphylococcus aureus*, while *Escherichia coli* and *Pseudomonas aeruginosa* are the commonest Gram-negative ones [2]. Of note, chronic infections are usually polymicrobial, but less common; atypical microorganisms may be isolated from them [2]. Therefore, the aim of this study was to record atypical microbial isolates from infected diabetic foot ulcers (DFUs).

We included 113 patients (70 men) with a mean age of 66.4 ± 11.2 years and mean diabetes duration of 14.4 ± 7.6 years. These were consecutive patients with DFUs presenting to our diabetic foot clinic with clinical signs of infection [4]. The study was approved by the institutional ethics committee. All patients gave their informed consent. Antibiotic treatment had been interrupted for the 7 preceding days. Deep-tissue specimens were obtained from the ulcers by 4 mm biopsy punches (Kai Europe GmbH, Solingen, Germany). Quantitative tissue cultures were performed using standard procedures, as reported elsewhere [4].

We have isolated the following microorganisms once (i.e. at one occasion):

- *Abiotrophia defectiva*
- *Providencia rettgeri*
- *Providencia stuartii*
- *Citrobacter koseri*
- *Citrobacter freundii*
- *Serratia marcescens*
- *Serratia fonticola*
- *Stenotrophomonas maltophilia*
- *Pantoea agglomerans*
- *Aeromonas sobria*
- *Acinetobacter baumannii*
- *Enterobacter cancerogenus*
- *Proteus vulgaris*
- *Staphylococcus hominis*
- *Staphylococcus capitis*
- *Staphylococcus warneri*

The following microorganisms were isolated repeatedly (i.e., 2-3 times) from DFUs:

- *Staphylococcus haemolyticus*
- *Enterococcus faecium*
- *Klebsiella oxytoca*

In 18 of the 23 patients, the atypical microorganisms were isolated alongside the usual pathogens, i.e. they were part of a polymicrobial infection. In these patients, the atypical microorganisms contributed to the infection, and were given serious consideration when choosing the systemic antibiotic regimen.

All 23 patients reported prior antibiotic use. In 2 patients, ulcer duration was 2 months. In 21 patients, it was >4 months, with median ulcer duration of 8 months (range: 5-84 months). The longest ulcer duration was seen in 2 patients: 84 months (*Morganella morganii*) and 24 months (*Stenotrophomonas maltophilia*). Prior hospitalization was noted in 2 patients. Frequent consultations in outpatient clinics were noted in 13 patients; these consultations included clinical examination, ulcer debridement, and prescription of systemic antibiotics.

Data on atypical pathogens in infected diabetic foot ulcers are few. Reasons include the fact that many microbiology laboratories do not determine such microorganisms as they consider them to be mere contaminators, while clinicians are often unaware of them. Shankar *et al.* reported that *Proteus vulgaris, Citrobacter koseri, Citrobacter freundii,* and *Klebsiella oxytoca* are rare isolates in some geographic regions [5]. In Europe, *Serratia marcescens* has been reported to be a rare pathogen [6].

In conclusion, atypical pathogens in infected diabetic foot ulcers are more common than believed to date. Also, they are not the result of mere contamination, but may be already present as pathogens. Risk factors for the appearance of such atypical pathogens are prior antibiotic use, frequent consultations in outpatient clinics, and long ulcer duration.

**Disclosures**: NP has been an advisory board member of TrigoCare International. He has participated in sponsored studies by Novo Nordisk and Novartis, and received honoraria as a speaker for Astra-Zeneca, Eli-Lilly, Novo Nordisk, and Pfizer. He also attended conferences sponsored by TrigoCare International, Novo Nordisk, Sanofi-Aventis, and Pfizer. PP has been an advisory board member of Gilead Science and MSD. He has received honoraria by ABBVIE, Gilead Science, and attended conferences sponsored by Actelion, Janssen, BMS, and MSD. EM has participated in sponsored studies by Novo Nordisk and Novartis, and attended conferences sponsored by Wyeth, Pfizer, and Bayer.

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