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ORIGINAL ARTICLE

Investigation of the effectiveness of *Syzygium aromaticum*, *Lavandula angustifolia* and *Geranium robertianum* essential oils in the treatment of acute external otitis: A comparative trial with ciprofloxacin

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KEY WORDS
Acute external otitis;
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Infection;
Inflammation;

Background: Antibiotics and anti-inflammatory agents are the mainstay of acute external otitis (AEO) treatment. The present study investigated the effectiveness of a combination herbal drop (Lamigex) composed of essential oils from *Syzygium aromaticum*, *Lavandula angustifolia*, and *Geranium robertianum* in the alleviation of AEO symptoms and compared its effects to those of ciprofloxacin 0.3% drop.
Methods: Seventy patients were randomly assigned to receive ciprofloxacin 0.3% ($n = 35$) or Lamigex ($n = 35$) drop. Each group was administered with three drops every 12 hours for a week. Patients were examined for AEO symptoms and ear discharge cultures at baseline

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Lavandula angustifolia;
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as well as at the end of trial. Pain severity was also recorded using a visual analogue scale at baseline, the 3rd day, and the 7th day of the trial.
Results: All assessed symptoms (tenderness, itching, erythema, edema and discharge) were equally improved in the ciprofloxacin and Lamigex groups by the end of trial ($p > 0.05$). There were remarkable reductions in the visual analogue scale score by the end of trial in both groups ($p < 0.001$). However, the rate of pain improvement was not found to be significantly different between the groups, either at the 3rd or 7th day of trial ($p > 0.05$). The numbers of positive cultures for all tested microorganisms were clearly reduced by the end of the trial in both groups but were not significantly different between the groups ($p > 0.05$).
Conclusion: The herbal combination drop that was investigated in the present study exhibited good efficacy in reducing the burden of infection as well as AEO symptoms.

Introduction

Acute external otitis (AEO) refers to inflammation of the external ear canal[1,2] which affects four out of 100 people every year.[3] This disease occurs under certain conditions involving temperature, humidity, and ambient water. The chief complaint of patients is usually severe unilateral pain and itching of the ear. In the early stages, AEO can cause mild irritation with redness and slight edema in the ear canal. However, at advanced stages, the symptoms would be edema and increased secretions in the ear canal, and might be accompanied by palpable adenopathy localized around and behind the ears.

Severe edema of the ear canal can cause loss of hearing.[2–4] *Pseudomonas aeruginosa* is the most common pathogen for AEO, being responsible for about 40% of illnesses, followed by *Staphylococcus aureus*, which accounts for 9% of AEO cases.[1] Other microorganisms such as *S. epidermidis*, *Proteus* species, *Streptococci*, *Enterococci*, and other Gram-negative bacilli as well as fungi (e.g., *Candida albicans*) have also been reported from AEO cultures.[3–5] The first step in treating AEO is the use of ototopical antibiotics. Other medications include organic acids (e.g., 2% acetic acid) and anti-inflammatory agents (e.g., betamethasone).[2,3] Despite the widespread use of ototopical antibiotics, bacterial resistance is an important concern which necessitates the development of novel therapeutic agents, especially those of natural origin. Heretofore, numerous plants have been reported to possess antibacterial, antiviral, and antifungal properties.[6–12] *Syzygium aromaticum* is a broad-spectrum antimicrobial, anti-inflammatory, analgesic, and healing agent.[13,14] *Lavandula angustifolia* and *Geranium robertianum* are two other medicinal plants which possess antimicrobial and anti-inflammatory properties.[15]

In the present trial, the antimicrobial efficacy of a combination herbal drop composed of essential oils from *S. aromaticum*, *L. angustifolia*, and *G. robertianum* was investigated in patients with AEO and compared to that of ciprofloxacin, a widely used medication.

Materials and methods

The present study was a noninferiority trial that was designed to indicate that the Lamigex combination herbal drop is at least as effective as ciprofloxacin 0.3% drop (as a standard and widely prescribed drug) in the alleviation of AEO symptoms. Participants were patients aged 18–60 years who were referred to the ENT department of the Baqiyatallah Hospital (Tehran, Iran) with initial AEO symptoms such as pain, itching, edema of the ear canal, tenderness, or irregular ear discharge. Each patient filled out a questionnaire, and the collected information was compiled to study and compare the demographic and laboratory data. The project was approved by the Baqiyatallah University of Medical Sciences (Tehran, Iran) ethics committee, and written informed consent was obtained from the patients.

Patients were randomly assigned to receive a ciprofloxacin 0.3% drop or the herbal combination drop (under the name Lamigex). Each group was administered with three drops every 12 hours for a week. The active ingredients of Lamigex drop were essential oils of *S. aromaticum*, *L. angustifolia*, and *G. robertianum*, which were prepared using a steam distillation method and mixed in equal proportions.[6–8,10] The drops were used after cleansing the ear canal. Randomization was performed individually, and patients were alternatively allocated to treatments encoded as A or B, with the first code being chosen randomly. The patients were allowed to consume analgesics such as acetaminophen or acetaminophen codeine, if necessary, instead of using over-the-counter non-steroidal anti-inflammatory drugs.

Patients were examined for tenderness, itching, irregular discharge, redness, or edema of the ear canal at baseline as well as at the end of trial. The pain score was recorded using a visual analogue scale (VAS) at baseline, the 3rd day, and the 7th day of the trial. The applied VAS was designed as a 100-mm horizontal line without scaling, in which 0 was marked as "no pruritus" and 100 was marked as "unbearable pruritus." Patients were then instructed to place a vertical mark reflecting their pruritus severity. Baseline and post-trial cultures of ear discharge were also investigated. In case of no therapeutic response or worsening of symptoms, administration of Lamigex was immediately discontinued; the patient was then excluded and they subsequently underwent standard treatment (three drops of topical ciprofloxacin every 12 hours).