

Is the Acidic pH of the External Auditory Canal Playing a Significant Role in the Treatment of Acute Otitis Externa?

OANA RUXANDRA IANA¹, DRAGOS CRISTIAN STEFANESCU^{1,2,3*}, VIOREL ZAINEA^{1,4}, RAZVAN HAINAROSIE^{1,4}

¹Carol Davila University, Medicine and Pharmacy Faculty, 8 Eroii Sanitari Str., 050474, Bucharest, Romania

²Gen. Dr. Aviator Victor Anastasiu National Institute of Aeronautical and Spatial Medicine, 88th Mircea Vulcanescu Str., 010825, Bucharest, Romania

³Carol Davila University Central Emergency Military Hospital, 88th Mircea Vulcanescu Str., 010825, Bucharest, Romania

⁴Institute of Phonoaudiology and Functional ENT surgery Prof. Dr. Dorin Hociota, 21th Mihail Cioranu Str., 050751, Bucharest, Romania

Variable pH values for skin have been reported in the literature, all within the acidic range, varying from 4.0 up to 7.0. The origin of the acidic pH remains conjectural, and several factors have been incriminated with this role, such as eccrine and sebaceous secretions as well as proton pumps. Keeping low levels of pH prevents microbial dispersal as well as multiplication. The skin in the external auditory canal is also covered with this acidic mantle with antimicrobial value. Changes of pH in the external ear can lead to acute otitis externa. This condition is defined by the inflammation and infection of the cutaneous and subcutaneous tissues of the external auditory canal. 10% of the world's population may suffer from acute otitis externa at least once in their lifetime. This paper aims to consolidate the relevance of an acidic pH in the healthy external ear and its relation to the pathogenesis and treatment of otitis externa through a prospective and interventional clinical study on 80 patients who presented to the outpatient department at Prof. Dr D. Hociota ENT Institute in Bucharest.

Keywords: pH, acute otitis externa, acid

Stratum corneum, the most superficial layer of the skin has an acidic pH which prevents commensal skin microflora from becoming pathogenic and plays a pivotal role in the lipid barrier penetrability [1-4]. Skin in the external auditory canal (EAC) is also covered with an acidic mantle, and according to previous studies, this happens due to the presence of cerumen which is believed to have a hydrophobic and bacteriostatic role [5].

Other authors show in their papers that the absence of cerumen in the external auditory canal can lead to the development of an acute local infection named otitis externa [6-7]. This condition was initially described by Mayer in 1844 and thought to be strictly a fungal infection [8].

Since then it has become of great interest for research due to the high number of patients developing this condition at some point in their life, 10% of the global population being affected at some point during their lifetime [9]. It has been classified by its duration in acute otitis externa (AOE) when it manifests for less than six weeks and chronic otitis externa (COE) when symptoms exceed this duration [10].

Patients usually present to the outpatient department (OPD) complaining of a sore ear, aural fullness and hearing loss. Clinical examination reveals tragal tenderness, which is considered a pathognomonic sign for this condition, oedema, erythema of the EAC and quite often seropurulent otorrhea. Sometimes the oedema is significant, causing the EAC to narrow up to the point that the tympanic membrane cannot be visualised.

Experimental part

The authors conducted a prospective and interventional study on 80 patients who presented to the OPD at Prof. Dr D. Hociota ENT Institute in Bucharest between 1st of May 2017 and 31st of August 2017. 50 of the patients were included in the study group, and 30 patients were included in the control group. The latter lot has been selected from

consecutive patients who presented to the OPD for non-otological complaints.

All enrolled patients were aged between 21 and 61, the male to female ratio being 1:1.25. All patients underwent a swab sampling from the EAC on presentation.

Exclusion criteria from the study were considered the following: any immunodeficiency (diabetes, autoimmune diseases, HIV, cancer treatment), fungal infections (after culture and sensitivity results came back), malignant otitis externa, acute or chronic suppurative otitis media and patients who already were started on treatment.

A detailed history was taken including hygiene habits such as cotton buds usage or excessive exposure to water (swimming).

pH was measured three times during the study: on the day of presentation considered day 0, day 7 and day 21 to both groups. All 50 patients' culture and sensitivity came back positive for bacterial infection. The measurement of the pH in the EAC was performed by placing a probe in the outer part of the canal and maintaining contact with the posterior wall long enough to acquire a constant value.

They all received treatment with a 0.2% Ciprofloxacin solution which had according to the manufacturer a pH value of 3.7. 3 drops of Ciprofloxacin were administered QDS locally, and patients were advised to stop using cotton buds and take precautions to prevent water from getting in the ear while washing their hair or showering during the study.

In severe cases p.o. (per os) Augmentin 1g TDS was also prescribed. In the cases that presented an EAC stenosis, a thin ear packing was inserted and changed daily. Patients in the study group were followed up in the OPD at 3 days, 7 days, 14 days and 21 days but pH was only measured in 3 critical moments: day 0, day 7 and day 21.

Results and discussions

Age and gender distribution were random. Patients' average age from the study group was 41 years old and in

*email: cristiandragos@hotmail.com; Phone: 0730047455

#All authors have contributed equally to this paper.

the control group was 40. Most of the patients in the study group were in their 3rd and 5th (fig. 1) decades of life, and in the control group, the majority of the subjects were in their 4th decade of life.

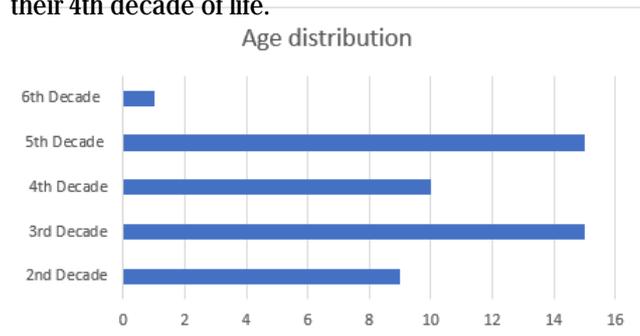
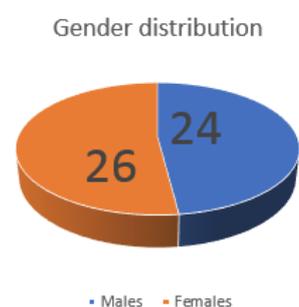


Fig. 1. Study group age distribution

Gender distribution in the study group revealed that more female patients presented with acute otitis externa in our OPD (fig. 2) and in the control group female gender also prevailed.



Fi.2. Study group gender distribution

Culture and sensitivity test results revealed several pathogenic bacteria such as *Pseudomonas aeruginosa* and *Staphylococcus aureus*, but most of the pathogens were commensals microflora like *Staphylococcus epidermidis* or *Diphtheroid* species.

All patients received the same ear drops, 0.2% ciprofloxacin which has an antibacterial spectrum that covers all the microorganisms mentioned above. According to the manufacturer, the pH of the solution is 3.7, and it fights the ear condition through two mechanisms because both *Pseudomonas aeruginosa* and *Staphylococcus aureus* are considered to have optimal growing conditions at a pH between 6.5 and 7.3 [11 -14]. Application of a 3.7 pH solution lowers the local pH interfering with cellular homeostasis while the antibiotic inhibits bacterial replication.

The mean pH value measured in the control group was 4.462 ± 0.552 meeting up with the expected values. All pH values at day 0 in the study group were higher than those measured in the control group, gradually decreasing at 7 days, reaching approximately normal values at day 21 (fig. 3 and fig. 4).

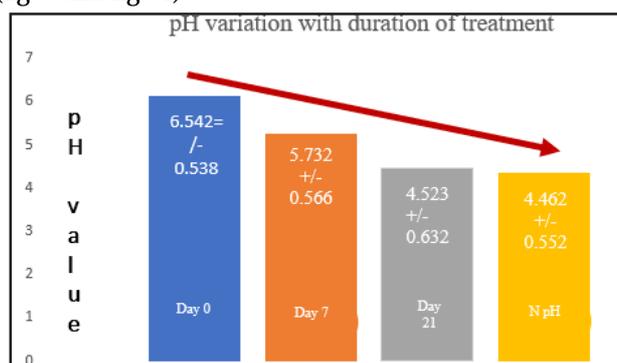


Fig.3. Variation of pH values during treatment and comparison with normal pH

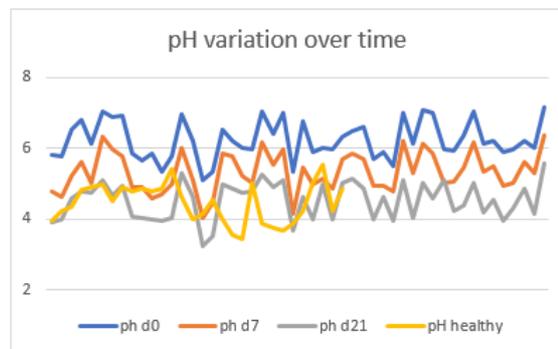


Fig. 4. Variation of pH over time

The fall between day 0 and day 7 in means of pH values was 0.913 ± 0.192 , and between day 7 and day 21 it was 0.808 ± 0.293 . The overall fall between day 0 and day 21 was 1.718 ± 0.308 .

Conclusions

The authors observed through this study that the pH of the normal external ear has an acidic value and it becomes more alkaline in acute otitis externa. This study demonstrates that once the bacterial infection is eradicated the pH values slowly regress to more acidic ranges. Although decreasing the local pH is the main physical treatment for acute otitis externa and its association with an antibiotic determines good clinical response, further studies would be necessary to evaluate more effective treatment modalities that may address the cumbersome issue of chronic otitis externa which most of the time is a consequence of treatment failure of its acute counterpart.

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