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ORIGINAL ARTICLE

Sulfated glycosaminoglycans in human vocal fold lamina propria[☆]

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KEYWORDS

Larynx;
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Abstract

Introduction: The distribution, concentration and function of glycosaminoglycans in the various vocal fold tissues are still unclear.

Objective: To evaluate the distribution and concentration of sulfated glycosaminoglycans in different layers of the human vocal fold according to gender and age.

Methods: We used 11 vocal folds obtained from cadavers (7 men and 4 women) with no laryngeal lesion, less than 12 h after death, and aged between 35 and 98 years. The folds underwent glycosaminoglycans extraction from the cover and ligament, and post-electrophoresis analysis. Data were compared according to the layer, age and gender.

Results: The concentration of dermatan sulfate was significantly higher in all layers. No differences were observed in the total concentrations of glycosaminoglycans in layers studied according to gender. It is significantly lower in the cover of individuals aged below 60 years.

Conclusion: Dermatan sulfate, chondroitin sulfate, and heparan sulfate were observed in the human vocal folds cover and ligament of both genders, with the concentration of dermatan sulfate being significantly higher in all layers. glycosaminoglycans concentration on the cover is significantly lower in individuals below 60 years compared with elderly.

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PALAVRAS-CHAVE

Laringe;
Glicosaminoglicanas;
Pregas vocais

Glicosaminoglicanos sulfatados na lâmina própria de prega vocal humana**Resumo**

Introdução: A distribuição, concentração e função dos glicosaminoglicanos nos diversos tecidos da prega vocal ainda não está esclarecida.

Objetivo: avaliar a distribuição e concentração dos glicosaminoglicanos sulfatados nas diferentes camadas da prega vocal humana de acordo com o sexo e a idade.

Método: Foram utilizadas 11 pregas vocais obtidas de cadáveres (7 homens e 4 mulheres) sem lesão de laringe, com menos de 12 horas de óbito e com idade entre 35 e 98 anos. As pregas foram submetidas à extração de glicosaminoglicanos da cobertura e ligamento e leitura pós eletroforese. Os dados foram comparados segundo a camada, idade e sexo.

Resultados: A concentração de Dermatan sulfato foi significativamente maior em todas as camadas. Não foram observadas diferenças nas concentrações totais de glicosaminoglicanos nas camadas estudadas quanto ao gênero. É significativamente menor em indivíduos com idade abaixo de 60 anos na cobertura.

Conclusão: Dermatan sulfato, condroitim sulfato e heparan sulfato foram observados na cobertura e ligamento de pregas vocais humanas, de ambos os sexos, sendo a concentração de dermatan sulfato significativamente maior em todas as camadas. A concentração de glicosaminoglicanos na cobertura é significativamente menor em indivíduos abaixo de 60 anos em comparação com idosos.

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Introduction

The vocal folds are adapted for speech function. The vibration of the vocal folds depends on its histological structure, especially of the lamina propria (LP), stratified in the free edge region in three layers: superficial, intermediate and deep. All of them consist of cells and extracellular matrix, differing qualitatively and quantitatively from each other, especially as to the fibrous proteins (collagen and elastic fibers) and interstitial proteins.¹

Among the interstitial proteins, the glycosaminoglycans (GAGs), proteoglycans (PG), and non-collagenous glycoproteins are notable. They influence viscosity, hydration and tissue volume.^{2,3} The differences in the arrangements and quantities of components of the extracellular matrix, and also the different interactions of these components with each other and the cells, are dynamically adjusted to the functional demands of each tissue.⁴⁻⁶ In the case of the vocal folds, this functional demand is the production of the mucosal wave and, consequently, the vibration of the tissue and the formation of the sound wave.⁷

Pawlak et al.² were the first to study the PGs and GAGs in vocal fold LP. The expression of hyaluronic acid receptor, keratan sulfate, chondroitin sulfate, heparan sulfate PG, and decorin was observed in various regions, as well as the cell types in the LP.

Paulsen et al.⁸ observed a reduction of sulfated GAGs in the tendons (extremities) of the vocal ligament. A greater loss of GAG in the vocal ligament tendon was observed with aging. These structures thus lose their ability to retain water and the viscoelasticity of the vocal fold is impaired. Hammond et al.,⁹ used an indirect method to compare tissue that is incubated or not incubated with hyaluronidase and

observed that the concentration of hyaluronic acid (HA) in the LP was higher in males compared to females. The distribution also varied according to the layers and gender, being more evenly distributed among males and more concentrated in the deeper layers in females.¹⁰ Using a direct method, Lebl et al.¹¹ and Korn et al.¹² found a higher concentration of HA in female LP in relation to male and a trend for a decrease with aging. Since bovine testicular hyaluronidase is not specific for HA, it may have broken other GAGs present in the LP, such as chondroitin sulfate, which would explain the difference found in the two studies if there were also differences in the concentrations of the other interstitial proteins.

Knowledge of the distribution and concentration of interstitial macromolecules that have different characteristics, features and effects on the functionally stratified LP layers, will help to understand the normal physiology of phonation, aging and in pathological processes that have an impaired mucosal wave.

Thus, the objective of this study is to investigate the distribution and concentration of sulfated GAGs in the different layers of the vocal fold according to gender and age.

Methods**Prospective experimental study**

We used 11 vocal folds obtained in necropsies of 11 cadavers (7 men and 4 women) with no laryngeal lesion involved in the cause of death, procured within 12 h of death, and aged between 35 and 98 years. The project was approved by the Research Ethics Committee of a university (CEP 1203/07). Larynges were removed from the cadavers, and taken under

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