THE SEQUENCE OF RETICULARISATION OF EPITHELIUM OF HUMAN PALATINE TONSIL: SCANNING ELECTRON MICROSCOPIC STUDY

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Dedicated to the memory of doc. MUDr. et RNDr. Milan Černý, CSc.

The changes appearing during the development of the human palatine tonsil, both in the surface and in the tonsillar crypt epithelium, were studied from samples of the 16th to 40th prenatal weeks. From the 18th week, we observed areas of mesh-like epithelium in an originally homogeneous stratified squamous epithelium, i.e. the reticularisation began in the tonsillar crypt epithelium. The important role of the epithelial basal membrane in this process is discussed. The diffuse spongy-form type of reticularisation as well as the formation of the intraepithelial passages between the epithelial columns are described. The lymphoid cells and macrophages migrated through these microcrypts and they were frequently seen near the crypt epithelial micropores on the surface of the reticularised epithelium.

INTRODUCTION

The first to describe the reticularisation of the tonsillar crypt epithelium was Stöhr[1] at the end of the last century. This change of the surface and especially of the crypt epithelium was then for many decades thought to be a pathological condition caused by contact between epithelium and the microbial flora of the mouth cavity; by means of contact with the antigens of the food and the inspired air[2,3]. The idea about the arteficial phenomenon produced by pressure applied on the tonsil during tonsillectomy was also discussed[4]. The scanning electron microscope (SEM) has been used for the study of the tonsillar epithelium by many authors[5,6,7,8,9,10]. They described the reticularisation, formation of the intraepithelial passways as well as the crypt epithelial micropores. But the palatine tonsils, which they studied, were from the postnatal period and the samples had been acquired mostly from tonsillectomy.

MATERIALS AND METHODS

We have examined 35 palatine tonsils of human foetuses of both sexes from the 16th to 40th prenatal weeks. After thorough washing in physiological solution the material was fixed in a 10% solution of neutral formol, dehydrated in an ascending alcohol sequence (the last bath was absolute acetone) and then the specimens were coated with a 10 nm thin layer of Au + Pd. We used SEM Tesla BS 340. A method of metal coating of histological specimens[11,12] was also used for identification of the individual cell structures. Approximately one half of the specimens were processed traditionally for light microscopy (LM) and 7 μm thin sections were dyed by hematoxylin-eosine. We worked in such manner that each metal coated specimen had two "neighbours" dyed with hematoxylin-eosine.

RESULTS

The human palatine tonsil is covered by stratified squamous non-keratinised epithelium which on some places changes into mesh-like – reticularised epithelium. The reticulatisation occurred for the first time in the 18th prenatal week, just after we observed the separation of the epithelial cells especially in the tonsillar crypt epithelium. From the 20th prenatal week, areas of reticularisation were also described on the surface epithelium (fig. 1). We believe that the basal membrane of the epithelium has an important role in this process. The oedema of the subepithelial tissue and the wavy basal membrane, observed in the light microscope, is caused, in our opinion, by the accumulation of cells beneath. This precedes the separation of the epithelial cells. By using transmission electron microscope (TEM) we described enlargement of the intercellular spaces, especially in the basal layer of epithelium, as well as stretching and eventually tearing of the wavy basal membrane. The reticularisation then spreads gradually through the epithelium by two ways: a) The epithelium looks like a spongy structure; the cells form a wide meshed net with cavities, in which the postmigrated

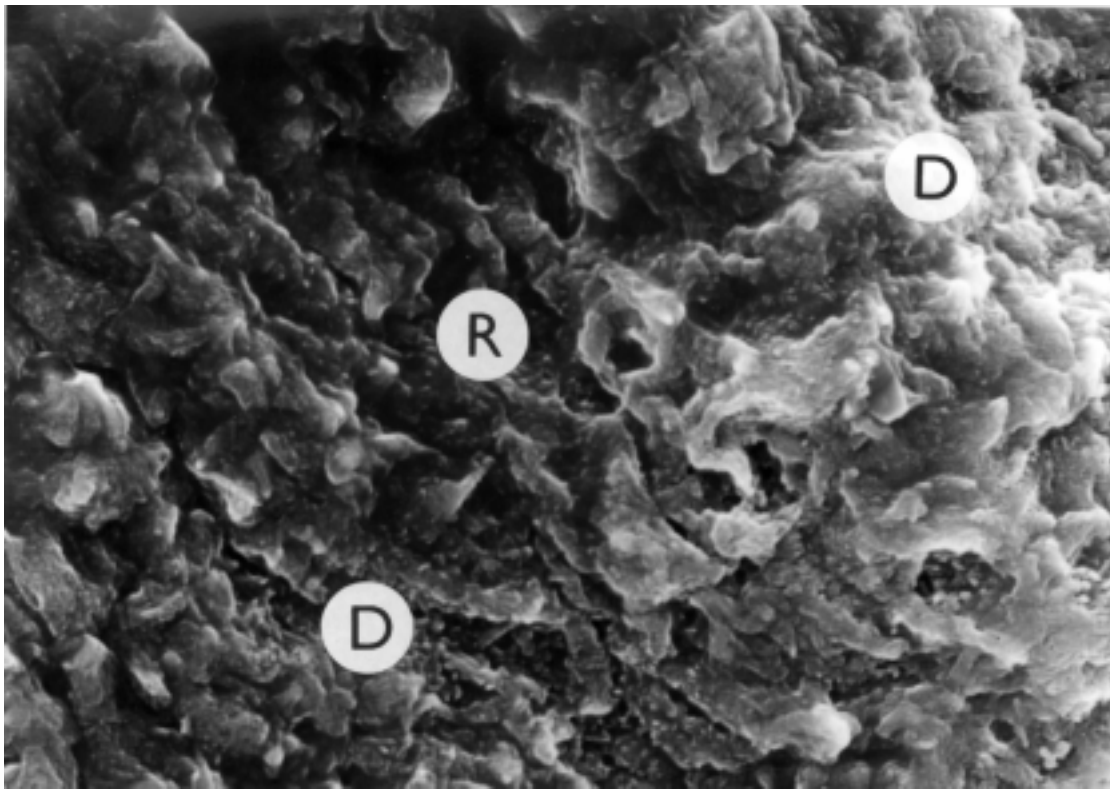

Fig. 1. The beginning of the reticularisation (R) of the surface tonsillar epithelium. "Calm" stratified epithelium (D). Sample from the 20th prenatal week. SEM – magn. x 1230.

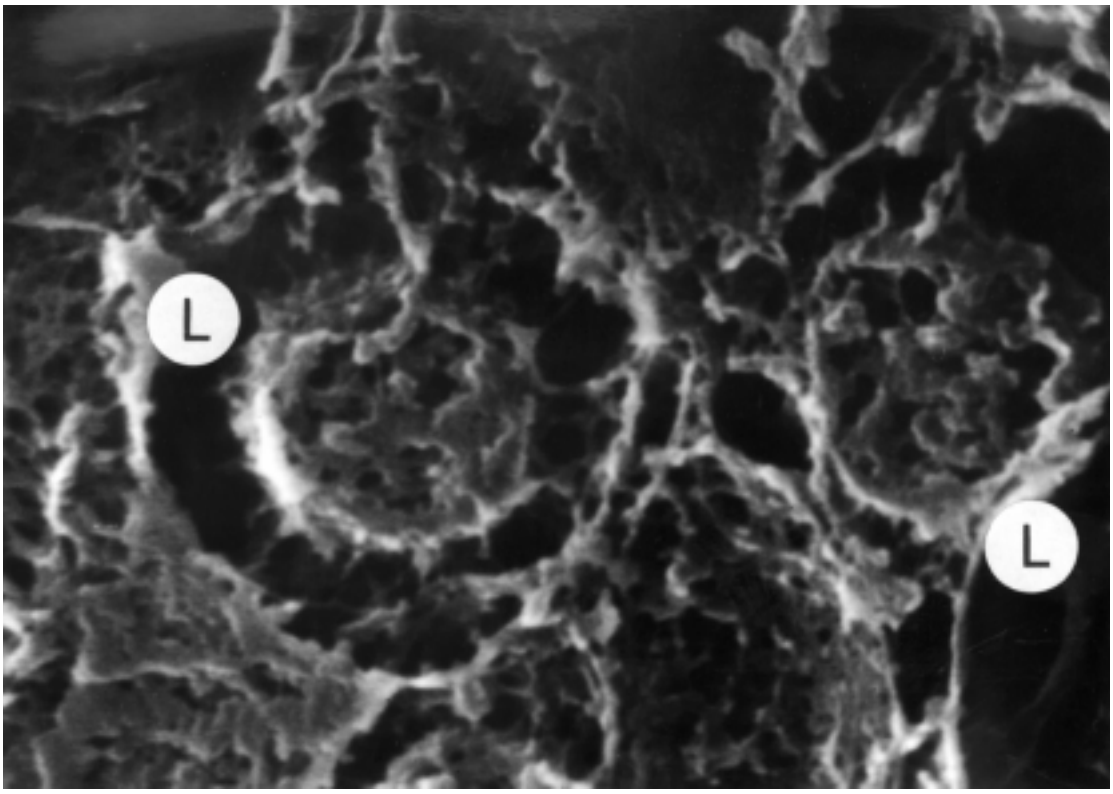

Fig. 2. Postmigrated lymphoid cells (L) temporarily situated in the tonsillar crypt epithelium. Sample from the 35th prenatal week. SEM – magn. x 10000.

lymphoid cells are temporarily situated (fig. 2). b) The epithelial cells form columns oriented perpendicularly to the surface of the mucosa and between them intraepithelial passages (microcrypt) are formed. Via these passages the free cells migrate into the lumen of the tonsillar crypt to make contact with antigens.

By using SEM, we described openings of these intraepithelial passages as the crypt epithelial micropores on the surface of the reticularised epithelium. The lymphoid cells were frequently observed in the proximity of these pores.

DISCUSSION

Many authors have studied the structure of human palatine tonsils epithelium in light microscope, TEM, and SEM. However, in most cases the material came from tonsils of people suffering from chronic tonsillitis. Therefore the question whether the epithelium is "normal" is still open and frequently discussed in literature. This is the reason why we narrowed our study to the palatine tonsils from the prenatal period. Lenz[7], Howie[5] and Kawabata[10] have used SEM to describe both "calm" stratified squamous tonsillar crypt epithelium and reticularised epithelium. Our findings comply with this knowledge. In the early prenatal period the palatine tonsil is covered only by a compact type of stratified squamous epithelium whose cells, with time, gradually form an overlapping pattern. From the 18th week we described the beginning of reticularisation in the crypt epithelium as did Howie[5], Perry[9], Perry, Jones and Mustafa[13] from specimens obtained by tonsillectomy. Kodama and Hoshino[14] and Higashiwa, Ohtani and Masuda in more detail[15] described pores in the basal membrane in their study of the relation between epithelium and subepithelial capillaries which according to them are the place where the lymphoid elements enter the epithelium. Beltz and Heath[16,17] confirmed these findings in the reticularised epithelium of canine palatine tonsil; they used the term "fenestrated basal membrane". Our discovery of wavy basal membrane and the dilated intracellular space (TEM) complies with these results. The space between the epithelial cells in reticularised epithelium is connected with the openings in the basal membrane. They were first described by Lenz[7] as "Ultrakanalsystem" and later, Kawabata[10] named these openings as epithelial micropores. In his study he distinguished between wide microcrypts, which serve for migration of lymphoid cells through the epithelium, and narrow microcrypts whose function is still unclear. Slípka and Matějka[18] and Howie[19] described the lymphoepithelial relations in the palatine tonsils. Holibka[20] studied several tonsils from the prenatal period and described (mainly in TEM) reticularisation of epithelium, intraepithelial passages and migration of lymphoid cells. We found that the most detailed study of microcrypts was the work of Maeda, Mogi and Oh[21] who distinguished three different types of microcrypts based on their diameter.

For precise identification and classification of these structures a combined SEM and TEM study would be most appropriate. Nevertheless, with the use of the LM and SEM we described the reticularisation of both, the tonsillar crypt and surface epithelium as well as the crypt epithelial micropores and migration of free cells via the intraepithelial passages. These major structural changes that take place in the prenatal period, namely the reticularisation of the epithelium with the following migration of lymphoid cells into the crypt lumen, imply that reticularisation is a physiological process and that the palatine tonsil is, as far as its morphology is concerned, able to fulfill its imunological function by the end of the foetal period.

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