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Dacryoliths in chronic dacryocystitis and their composition (spectrophotometric analysis)

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ABSTRACT: Purpose. *To present the findings from histological and chemical analysis of large dacryoliths and correlate them with previous reports.*
Materials and Methods. *Dacryoliths were found in 8% of 216 dacryocystorhinostomy operations. In two cases with mild chronic dacryocystitis, large dacryoliths were extracted. The first case was a 42-year-old male with three dacryoliths in a lacrimal sac, presenting diverticulum-like formations, the second was a 22-year-old woman with one dacryolith at the entrance of the nasolacrimal duct. Chemical analysis was based on atomic absorption spectrophotometry (F.AAS) and on atomic emission spectrometry (AES). Light histological examination was also done.*
Results/Conclusions. *The findings were the same in both cases. Histological examination revealed amorphous organic material, and limited areas with the characteristics of calcium salt depositions. Chemical analysis showed mainly organic material with only minimal inorganic material. Explanations are offered about the formation of these dacryoliths. (Eur J Ophthalmol 1999; 9: 266-8)*

KEY WORDS: Dacryolith, Dacryocystitis, Dacryocystorhinostomy

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INTRODUCTION

It is uncommon to find dacryoliths during dacryocystorhinostomy in patients with chronic dacryocystitis, and the incidence ranges from 6.5-14% (1-4). The pathogenesis of dacryolith formation is obscure though various explanations have been proposed. Studies of their chemical composition are very few (5-9).

In this study we present the histological and chemical findings of two cases of dacryoliths in relatively young patients, found in a large series of dacryocystorhinostomies, and correlate them with international data.

MATERIALS AND METHODS

We found and extracted dacryoliths in 8% of a series of 216 dacryocystorhinostomies performed with or without silicone intubation (17 cases). The technique and observations were described in 1997 (4). In two of these cases the dacryoliths were quite large and we proceeded to their chemical and histological analysis.

The first case was a 42-year-old man with a three-year history of chronic dacryocystitis. Three dacryoliths covered by fibrinous membranes were encysted in lacrimal sac diverticulum-like formations, considerably limiting the flow to the nasolacrimal duct. These dacryoliths were brownish and their largest dimensions were 6 mm, 5 mm, and 3 mm (Fig. 1).

After preparation of the lacrimal sac and the nasal mucosa, silicone tubes were placed. The fourth postoperative day the patient had an episode of nasal hemorrhage. However, the final postoperative result was successful. This patient was operated in December 1995.

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The second case was a 22-year-old woman with a two-year history of chronic epiphora (serous-mucous discharge) with no clear inflammatory symptoms. The lacrimal sac was a normal size. The dacryolith obstructed the entrance of the nasolacrimal duct: it was brownish color and its largest dimension was 5 mm. No silicone intubation was done, and the postoperative course was also successful. The operation was done in April 1996.

All dacryoliths were examined by light microscopy, and chemical analysis was done as follows: flame atomic absorption spectrometry (F.AAS) for determination of Ca^{2+} and Mg^{2+} and atomic emission spectrometry (AES) with propane flame (flame photometry) for K^+ and Na^+. The equipment used was a Perkin Elmer 403 and a Bruno Lange M6a.

The inorganic and organic composition of the dacryoliths was based on the elements extracted from the total analysis of the inorganic components of the dacryoliths, and the behaviour of the material during ashing (great loss of weight at relatively low temperatures, inconsistent with solely inorganic molecular transformation).

RESULTS

Histological examination gave the same results in all cases: amorphous eosinophilic material, and some small areas with characteristics of calcium salt concentrations. No cellular elements. The results of the chemical analysis are illustrated in Table I. In both cases the composition of the dacryoliths was of organic nature and inorganic components accounted for only a small part of their total weight.

DISCUSSION

The mechanism of the formation of dacryoliths is obscure and is believed to be related to the highly variable circumstances that surround dacryolithiasis (10). Lacrimal sac diverticula and alterations in the channel wall, flow or fluid, causing gradual accumulation of cellular debris, have been held responsible (5, 11). The presence of antikeratine antibodies in one case supports this (7).

Chronic obstruction and inflammation of the sac causing a build-up of electrolytes, particularly calcium, have also been held responsible (6). Inflammation caused by fungi, *Aeromonas hydrophila*, or by an eyelash within the sac are other potential causes (12-15).

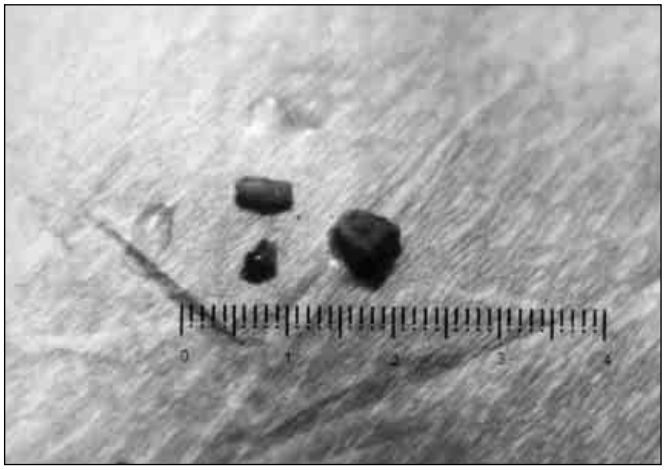

Fig. 1 - *Dacryoliths from case no. 1.*

A dacryolith due to breakdown products of adrenaline was found in a patient who used epinephrine (16) and a cholesterol dacryolith in a patient with hyperbetalipoproteinemia (17).

In the first of our cases the wall of the lacrimal sac presented diverticula-like formations and the dacryoliths were encysted within and covered by fibrinous

TABLE I - CHEMICAL ANALYSIS OF DACRYOLITH SAMPLES

	Sample 1: wt 25.7 mg Case No. 1	**Sample 2: wt 18.3 mg Case No. 2**
	Composition % (w/w)	
Ca^{2+}	0.79	0.036
Mg^{2+}	0.11	0.004
K^+	0.04	0.013
Na^+	0.21	0.006
Total	1.15	0.059
ORGANIC +ANIONS	98.85%	99.94%
INORGANIC (CATIONS)	1.15%	0.059%

The anions are detected with the organic matter in approximately the same amount as the cations

membranes. This observation gives evidence for further etiological considerations.

Histological examination of a dacryolith consisting of organic material revealed the existence of lobes and lobules built on an amorphous core (8). In another case histological examination showed that the dacryolith was composed of layers of cellular debris (11). In our cases, the dacryoliths consisted of amorphous organic eosinophilic material with limited areas presenting characteristics of calcium concentrations.

As regards the chemical analysis of dacryoliths, most reports mention inorganic materials, mainly calcium (5-7), and three cases found only organic material (8, 9, 11). In our two cases the dacryoliths consisted mainly of organic material with only a few inorganic elements. Chemical analysis was done by a spectrophotometric method with accurate quantitative analysis of all components (Tab. I).

Possible explanations for the form of the dacryoliths described in our study, from a chemical aspect and according to the literature (18), are the following:

a) Dehydration resulting in increased concentrations of soluble substances to levels of hypersaturation: formation of solid remmants may lead to dacryolith formation;
b) Denaturation-aggregation of water-soluble proteins due to temperature changes, pH changes or salt changes which change the electrolytic concentration of the tears.

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