Demodex folliculorum and oedema of the eyelash

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In 1842 the Frenchman Berger discovered the mite *Demodex folliculorum* and later introduced this parasite to medical science (Berger, 1845). After more than a century of sporadic literature on this topic, there has been a resurgence of interest in ophthalmology triggered off by a stimulating thesis on *Demodex folliculorum* blepharitis (Coston, 1967).

Belonging to Class Arachnida, Order Acarina, *Demodex folliculorum* can infest the eyelashes, hair, and meibomian and sebaceous glands of man. The adult (Fig. 1) is vermiform in appearance, measuring 280 μ in length in the male, 270 to 440 μ in the female, and can be found in great numbers in the hair follicles. Possessing a well-developed prostoma and biting apparatus, the octopod *Demodex folliculorum* is characterized by distinctive annular markings on the abdomen. The legs, though rudimentary, are quite active and when placed on a microscope slide the parasite demonstrates an impressive degree of mobility. The clinician can readily demonstrate this property *in vivo* by causing evacuation of the hair follicle when the skin surface is stimulated with an irritating agent such as ether. Even so, in the presence of the bright light of the biomicroscope, complete evacuation does not occur, as the head appears photosensitive, and the observer becomes aware of its presence only by the sight of a number of cream-coloured tails protruding from the lid margin like fine bristles.

FIG. 1 *Adult Demodex folliculorum located on an eyelash.* $\times 425$

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The immature adult is more slender in appearance, often longer than its later counterpart and quite inactive. The shield-shaped egg has been measured by Gmeiner (1908) as 0.08 mm. in length and 0.04 mm. in width. In searching for the parasite an epilated lash is placed in a peanut oil preparation on a microscope slide. Careful scrutiny with light microscopy may reveal the whole gamut of development from the egg, through larval, protonymph, and deutonymph, to the adult stage.

Where heavy infestation of the eyelids occurs, accumulation of mite faeces produces a distinctive cuff of plastic-like material around the eyelash. The parasite has also been described in the meibomian gland and in chalazion formation, and is believed responsible for pityriasis folliculorum and a type of acne rosacea (Coston, 1967). A variable incidence has been recorded throughout the world; and this often depends on the number of eyelashes epilated and the experience of the observer in the technique of examination.

Other demodectic mites can infest mammals, including *Demodex bovis* in cattle, *Demodex cati* in cats, *Demodex phylloides* in pigs, and *Demodex canis* in dogs. The last mentioned is of interest as it causes red mange in dogs and morphologically appears similar to *Demodex folliculorum*.

The study of the eyelash is one which has received scant consideration from ophthalmic researchers. Considering the intimate and prolonged association of *Demodex folliculorum* with the hair follicle, it is interesting to consider if it has any deleterious effect on the cilia. From the following observations it appears that the presence of this acarid is responsible for disease of the eyelash.

Methods and material

An epilated cilium noted to have a single adult *Demodex folliculorum* parasite adherent to the hair bulb was fixed in 4 per cent. glutaldehyde solution and embedded in epoxy resin. Many sections 0.5 μ in thickness were cut and the specimens studied.

Results

The section performed in the zone of parasitic adherence corresponded with the distal portion of the bulb of the eyelash. At the site corresponding with the original area of attachment was a well-defined region showing distinctive pathological features: marked intercellular oedema with teasing out of the cellular components (Figs 2 and 3, overleaf) and associated with the localized area of hydrops was hyperproduction of the hair keratin.

In reviewing a large series of chronic cases of demodectic infestation of the eyelids, this observer has sometimes noted an alteration in the physical character of the eyelashes. An epilated cilium is held with a fine pair of forceps and briskly tapped end-on against a solid surface, such as the anaesthetized cornea or conjunctiva. A healthy eyelash will display a somewhat vibrant character readily resuming its normal configuration (Fig. 4). This resilience is not unexpected in view of the term vibrissa, which is used for such hairs.

In demodectic infestation, however, the cilium fails to possess this expected property, and tapping produces a crumpled effect similar to that expected to be seen if one substituted a strip of moistened blotting paper (Fig. 4, overleaf). The earlier mentioned hydropic features of the disordered cytoarchitecture of the cilium appears to explain the soggy or waterlogged nature of the eyelash.

A survey was made of a series of 100 eyelashes from two groups of adult patients, the first exhibiting the presence of the acarid and the second free from parasites. There were five patients in each group and ten cilia were taken from each subject.

FIG. 2 Cross-section of eyelash, displaying pathology at original site of adherence and located strictly to one side of the bulb.

× 192

FIG. 3 Higher magnification, demonstrating oedema of eyelash with teasing out of the cellular elements. × 850

In the group with no infestation 46 (92 per cent.) of the fifty eyelashes showed normal resilience, and four (8 per cent.) were diseased. In this group it would be difficult to rule out previous contact with this commonly occurring mite.

In the group with established parasitization 62 per cent. of the eyelashes were healthy, and 38 per cent. were abnormal. It would appear therefore that soggy eyelashes generally indicate the presence of an associated concomitant demodectic infestation.

FIG. 4 Diagrams showing normal resilience of healthy cilium (left), and crumpled effect on diseased soggy eyelash (right)

Comment

It should be pointed out that this particular case is representative of mild parasitization as only one mite is involved. It is possible for twenty or more acarids to cling to one eyelash, and so cause much more severe damage.

A number of factors may be involved in the oedematous process affecting the eyelash. The incidence in the community varies Jacobsen (1969), in New York City, recorded that as many as 40 per cent. of his adult patients were affected. Living in the repository of the follicle they enjoy close proximity to the body of the eyelash and specimens often appear adherent to the hair. The adult possess well-developed powers of locomotion and its activity is believed to be diurnal. The immature elongated form does not appear to shift from its position of lodgement and thus exerts a prolonged effect on the nutrition of the cilium.

At present there are gaps in our knowledge of the physiology of digestion of the acarids. Demodetic mites possess a voracious appetite and enjoy a diet of sebum; it is possible that the combination of potentially irritating lipolytic enzymes combined with the well-developed biting apparatus initiates the cycle of ingestion and plays a role in disease of the hair.

In earlier studies of the ultrastructure of this mite a vector capacity for bacterial infection was established (English, Iwamoto, Darrell, and De Voe, 1970). The presence of micro-organisms on the integument of the parasite may also be responsible for enzyme production which reacts adversely on the nutrition of hair.

Symptoms of irritation result from the accumulation of mite excreta and eventually the shaft of the lash may be insulated with foreign material. Extension can even advance past the eyelid border producing the classical cuffing seen in advanced cases. It is difficult to ascertain whether this material plays a role in softening the shaft. If so, a considerable length of the eyelash would be exposed to a potentially noxious agent.

A careful study of a large series of cases over the last decade, has given Coston (1969) the clinical impression that in long-standing infestation with *Demodex folliculorum* some loss of the eyelashes may result. The present histopathological findings of the diseased soggy eyelash appear to be consistent with his observations. This is further borne out by the relative ease with which these lashes may be pulled out, there being virtually no resistance. Finally, on a wider scale, it is interesting to consider the likelihood that body hair oedema produces shedding of hair in alopecia. In this context it is of note that Hirst (1919) mentioned of a report that his brother, who was bacteriologist of the General Military Hospital, Alexandria, reported finding numerous specimens of this parasite in scalp disease simulating alopecia areata.

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