

A Survey of the Conjunctival Flora of Clinically Normal Cats and Cats with Conjunctivitis

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SUMMARY

Conjunctival swabs obtained from 39 cats with conjunctivitis and from 50 cats with clinically normal conjunctivae were cultured for bacteria, mycoplasmas, viruses and chlamydiae. Non hemolytic streptococci and *Staphylococcus epidermidis* were isolated from both groups, but B hemolytic streptococci, rhinotracheitis (feline herpes I) virus, *Mycoplasma felis* and *Chlamydia psittaci* were recovered only from cases of conjunctivitis. The isolation rate of microorganisms was low; only two of 50 normal and 14 of 39 diseased cats yielded positive cultures.

RÉSUMÉ

Un relevé de la flore des conjonctives de chats sains et de chats atteints de conjonctivite

Cette étude consistait à rechercher des bactéries, des mycoplasmes, des chlamydies et des virus, dans des écouvillons des conjonctives de 50 chats sains et de 39 autres, atteints de conjonctivite. On isola des streptocoques non hémolytiques et *Staphylococcus epidermidis*, tant chez les témoins que chez les malades. On isola aussi, mais seulement chez les chats atteints de conjonctivite, des streptocoques bêta hémolytiques, le virus de la rhinotrachéite féline, c'est-à-dire l'herpès-virus félin I, *Mycoplasma felis* et *Chlamydia psittaci*. Le taux d'isolation de micro-organismes s'avéra toutefois faible, puisqu'on n'obtint des résultats positifs que chez deux des 50 chats sains et chez 14 des 39 qui souffraient de conjonctivite.

INTRODUCTION

A number of microorganisms have been associated with conjunctivitis in cats. In particular feline herpesvirus I (FVR) (2, 11), feline calicivirus (11, 16), reovirus (11, 15), *Chlamydia psittaci* (6, 11, 14, 17, 21), *Mycoplasma felis* (4, 5, 8, 9, 18, 19) and *Staphylococcus aureus* (1) have been implicated. However, little information is available regarding the recovery rate of these organisms, alone or in combination, from the inflamed or healthy feline conjunctiva. The few clinical surveys which have been conducted were directed toward establishing the importance of one or another of these agents rather than the relative significance of each as a conjunctival pathogen (3, 4, 15, 16, 18, 19, 20). The present study was undertaken to gain a more comprehensive view of the feline conjunctival flora in health and disease, as an aid to the diagnosis and rational therapy of infectious conjunctivitis in the cat.

MATERIALS AND METHODS

Thirty-nine cats, presented at the Ontario Veterinary College Clinic, from 30 different households or catteries, were sampled during a 22 month period. In all cases conjunctivitis was the major presenting problem, although 13 of the animals also exhibited rhinitis or other evidence of upper respiratory infection. Cases where mechanical irritation was an obvious cause of conjunctival inflammation were not included. A control group of 50 cats presented at the clinic

during the same period for reasons unrelated to conjunctivitis or respiratory problems, were also sampled for viruses, chlamydiae and bacteria. Thirty-five of these were submitted for mycoplasma isolation.

Conjunctival swabs were obtained by rolling a sterile cotton tipped applicator over the mucosal surface of the conjunctival sac, taking care to avoid contacting the surrounding skin or hair. In cases of bilateral conjunctivitis each eye was swabbed and the samples pooled for culture. Separate swab samples were taken from each cat for viral, chlamydial, bacterial or mycoplasma culture. After sampling, the cotton tip of each swab was immediately broken into a sterile bijoux bottle containing the appropriate transport medium. The transport media used were Stuart's medium¹ for bacteria and mycoplasmas, Eagle's minimum essential medium (EMEM)² with 75 units penicillin and 75 mg streptomycin per mL for viruses, and EMEM with 30 μ mol dextrose, 100 μ g streptomycin, 100 μ g vancomycin and 10 μ g gentamicin per mL for chlamydiae. In addition pharyngeal swabs were obtained from those cats with evidence of upper respiratory infection and placed in viral transport medium.

Samples were cultured from chlamydiae in embryonated hen's eggs (17) and passaged four times before being declared negative. Isolates were identified as *C. psittaci* on the basis of resistance to inhibition by sodium sulfadiazine (17).

Viruses were isolated by inoculation of feline kidney cell monolayers which were observed for five days for characteristic viral cytopathological changes.

Attempts to isolate mycoplasmas and bacteria were made using conventional culture methods (10, 13).

RESULTS

The results of conjunctival swab culture are outlined in Table I.

Viruses

Feline rhinotracheitis virus (FVR, feline herpes I) was recovered from a

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¹Gibco 141-0870, Grand Island Biologicals Co., Grand Island, New York.

²Gibco 320-1570, Grand Island Biologicals Co., Grand Island, New York.

TABLE I
ISOLATION OF INFECTIOUS AGENTS FROM CONJUNCTIVAL SWABS OF
CATS WITH CONJUNCTIVITIS AND CATS WITH CLINICALLY NORMAL CONJUNCTIVAE

Clinical Signs	Culture Results (no. positive/no. sampled)				Total Cats with Positive Isolation
	Virus ^a	Mycoplasma ^b	Chlamydia ^c	Bacteria ^d	
normal conjunctiva	0/50	0/35	0/50	2/50	2
conjunctivitis only	0/26	2/26	8/26	3/26	11
conjunctivitis and rhinitis	1/13	2/13	0/13	1/13	3

^aFVR (feline herpes I) was the only virus isolated.

^bAll mycoplasmal isolates were identified as *M. felis*.

^cAll chlamydial isolates were identified as *C. psittaci*.

^dBacterial isolates are outlined in Table II.

conjunctival swab in only one case, from which *Staphylococcus epidermidis* and B-hemolytic streptococci were also isolated. Feline rhinotracheitis virus was also isolated from a throat swab from this kitten and from throat, but not conjunctival swabs of four other cats.

Calici virus was cultured from eight throat swabs but no conjunctival swabs. All of these animals had rhinitis as well as conjunctivitis. Two littermates which had calici virus in the pharynx also yielded *Mycoplasma felis* from conjunctival swabs.

Mycoplasmas

Mycoplasma felis was recovered from conjunctival swabs in four cases (three households). In the one case which was a neonatal kitten with conjunctivitis but no other signs, the mycoplasma was the only organism isolated. Two other neonatal kittens, from a litter with neonatal conjunctivitis and upper respiratory disease, yielded *M. felis* from conjunctival swabs and calici virus from throat swabs as referred to previously. The fourth case involved chronic conjunc-

tivitis in an Abyssinian cat from which chlamydiae and nonhemolytic streptococci were isolated together with *M. felis*. This case is discussed in greater detail below (chlamydiae).

Bacteria

Bacterial isolations from cats with conjunctivitis are described in Table II. In all these cases the conjunctival exudate was purulent.

Bacteria were recovered from only two of the clinically normal cats. Non-hemolytic streptococci were isolated from one cat and *Staphylococcus epidermidis* was recovered from the other.

Chlamydiae

Chlamydia psittaci was recovered from the conjunctivae of eight cats with conjunctivitis. In one case a nine month old male Abyssinian was presented with marked bilateral conjunctivitis characterized by hyperemia, vascular injection and mucopurulent discharge. Conjunctivitis had been a recurring problem with this cat from six months of age when a corneal ulcer had been recognized and surgically

treated. Conjunctival swabs taken at the time of presentation were negative for virus but yielded *M. felis* and non-hemolytic streptococci as well as *C. psittaci*.

The other chlamydial isolations were obtained from seven Siamese cats from a single cattery, which were presented with varying degrees of conjunctivitis. This had become a chronic or recurrent problem in all ten cats in this household after the introduction of a young queen with conjunctivitis five months previously. No viruses, mycoplasma, or bacteria were isolated from these seven cats.

Chlamydiae were not isolated from any of the cats which did not have conjunctivitis.

DISCUSSION

From the results of this survey, the conjunctiva of the clinically normal cat would appear remarkably sterile. No virus, mycoplasma, or chlamydia was recovered from any of these cats. The bacteria *Staphylococcus epidermidis* and nonhemolytic streptococci were isolated from two cats only. In a previous study of normal feline conjunctival flora (4) mycoplasmal or bacterial growth was found in 34.2% of 240 conjunctival samples. This rate of isolation is still low compared to other species (1, 11) and it has been suggested that the lacrimal fluid or the rate of washing of the conjunctival membrane in the cat is such that organisms are unable to effectively colonize this area under normal circumstances (4, 11).

The cats with conjunctivitis also yielded a relatively low rate of isolation of any agent (14/39 cats of 7/30 households). This may have been due to previous treatments with antibiotics, although the cats were not being treated at the time of presentation. It is also possible that the cats were examined at the stage of the disease where the causative organisms had already been eliminated or inactivated by the animal's immune response.

No one organism was isolated with greater frequency than any other. Feline rhinotracheitis virus was recovered from the conjunctival and pharyngeal swabs of only one cat. This virus has been associated with severe upper respiratory disease and conjunctivitis, frequently involving ulceration

TABLE II
BACTERIA ISOLATED FROM CATS WITH CONJUNCTIVITIS

Case	Bacteria Isolated	Remarks
1	<i>Staphylococcus epidermidis</i>	Conjunctivitis only
2	<i>Staphylococcus epidermidis</i> and B hemolytic streptococci	Conjunctivitis only
3	Nonhemolytic streptococci	Conjunctivitis only, <i>M. felis</i> , <i>C. psittaci</i> cultured also
4	<i>Staphylococcus epidermidis</i> and B hemolytic streptococci	Neonatal conjunctivitis and upper respiratory infection, FVR also isolated

of the cornea (2). None of the cats examined in this study had corneal lesions. Moreover because cats chosen for this survey exhibited conjunctivitis as the principal complaint those with viral upper respiratory infection were selectively omitted.

Mycoplasmas were recovered only from cats with conjunctivitis. Even so their role in the pathogenesis of this disease is unclear. In previous reports *M. felis* has been implicated in feline conjunctivitis (5, 8, 18, 19). However, the organism has also been recovered from the eyes of normal cats (3, 4, 9) and reproduction of the disease with mycoplasma species experimentally is difficult to achieve (19).

Chlamydiae have not as yet been recovered from the conjunctivae of clinically normal cats. For this reason, and because chlamydial conjunctivitis can be readily induced experimentally (7, 12, 17) their isolation in cases of conjunctivitis has been considered significant (6, 7, 14, 21). This assumption is probably valid in cases where these are the only organisms isolated, but in mixed infections interpretation of the role of each organism is difficult. Chlamydial-mycoplasmal infection has been reported previously (6, 18), where it was felt that the mycoplasmal infection was probably secondary to the chlamydia but this could not be verified.

The importance of bacterial isolates is also difficult to assess, since the same organisms were recovered from normal conjunctivae. Nevertheless the involvement of these organisms whether as primary or secondary agents should be considered in cases of conjunctivitis particularly where a purulent exudate is present.

Even though no dominant etiologi-

cal agent for feline conjunctivitis was apparent in this survey, an indication of the organisms likely to be involved was provided. The findings also suggest that tetracycline, because of its broad effectiveness against mycoplasmas, chlamydiae and bacteria, would be a logical choice as the initial therapeutic agent in cases of infectious conjunctivitis in cats.

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