Isolation of unusual bacteria in canaliculitis: A series of four cases

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Abstract:
With increased availability of sophisticated microbiological techniques for isolation, growth and identification of micro-organisms the spectrum of organisms is rapidly. Herein we report four cases of canaliculitis with unusual organisms and highlight their clinical significance. To the best of our knowledge, there are no reports of isolation of Brucella melitensis and Leuconostoc species reported in English literature; and only one report of isolation of Myroides species from canaliculitis exists. Sphingomonas paucimobilis, is an uncommon isolate in canaliculitis. Extremes of age and occupational exposure may be possible risk factors for infection with uncommon organisms. Clinical features at presentation do not vary greatly with uncommon or multi drug resistant organisms’ hence sampling and microbiological assessment is warranted. The benefit of curettage in canaliculitis is manifold. Unusual organisms and opportunistic pathogens can be multi-drug resistant and determination of antibiotic susceptibility is important to initiate targeted therapy to ensure disease cure and prevent recurrences.

Keywords:
Canaliculitis, pediatric canaliculitis, concretions, Myroides, Leuconostoc, Sphingomonas

Introduction
Canaliculitis accounts for 2%–4% of lacrimal diseases and the usual causative organisms include gram-positive organisms such as Actinomyces, Staphylococcus, and Streptococcus species.[1–4] We describe four cases of canaliculitis with uncommon microbiological isolates and elaborate on their clinical relevance in terms of susceptibility to antimicrobial agents. There are no reports of isolation of Brucella melitensis and Leuconostoc reported in the English literature; and we also report the first case of isolation of Myroides species from childhood canaliculitis. Sphingomonas paucimobilis has been an uncommon isolate in primary canaliculitis.[5] Extremes of age and occupational exposure may be possible risk factors for infection with uncommon organisms. As there is significant overlap in the clinical presentation of canaliculitis caused by uncommon organisms sampling and microbiological workup are warranted. The benefit of curettage in canaliculitis is manifold in reducing the organismal load, increasing the potential space of antibiotic reservoir, and allowing microbiological assessment. This case series highlights that unusual isolates from canaliculitis can be opportunistic pathogens showing multi-drug resistance and determination of antibiotic susceptibility helps initiate targeted therapy. Patient consent has been obtained for publishing clinical photographs. The study adhered to the declaration of Helsinki.

Case Reports
Case 1
A 49-year-old male came to us with complaints of watering in his right eye of 3 months duration. On examination, there was erythematous swelling of the medial third of the lower eyelid and an inflamed pouting punctum [Figure 1a]. Debris expressed from the lower canaliculus on the application of pressure with cotton-tipped applicator was sent for microbiological examination. Gram’s staining of the canalicular contents revealed numerous gram-positive bacteria.
branching filamentous organisms and groups of gram-positive cocci in pairs and short chains among a large number of gram-negative cocobacilli [Figure 1b]. On aerobic culture, confluent pin-point alpha-hemolytic colonies and confluent translucent gray colonies grew on blood and chocolate agar at the site of inoculation [Figure 1c]. Anaerobic subculture from thioglycolate broth grew discrete whitish colonies with a “molar-tooth” appearance. The organisms were isolated as *Streptococcus* species, *Sphingomonas paucimobilis* [Figure 1d], and *Actinomyces* species. *Streptococcus* and *Sphingomonas* were sensitive to all antibiotics [Table 1], but *Actinomyces* species showed multidrug resistance.

**Case 2**

A 9-year-old child was brought by his parents with complaints of discharge from his right eye for 3 months. Careful examination of his right eye revealed upper canalicular edema, pouting punctum, and expression of purulent material on application of pressure over the upper canaliculus. Although rare in children, classical features hinted at the diagnosis of canaliculitis which was confirmed by expression of copious pus and multiple concretions on curettage. Gram’s staining of smears from the concretion revealed plenty of polymorphonucleocytes with few gram-negative bacilli per oil immersion field [Figure 2a]. On aerobic culture, growth of discrete, pale yellow colored colonies and groups of gram-positive cocci in pairs and short chains among a large number of gram-negative cocobacilli [Figure 1b]. On aerobic culture, confluent pin-point alpha-hemolytic colonies and confluent translucent gray colonies grew on blood and chocolate agar at the site of inoculation [Figure 1c]. Anaerobic subculture from thioglycolate broth grew discrete whitish colonies with a “molar-tooth” appearance. The organisms were isolated as *Streptococcus* species, *Sphingomonas paucimobilis* [Figure 1d], and *Actinomyces* species. *Streptococcus* and *Sphingomonas* were sensitive to all antibiotics [Table 1], but *Actinomyces* species showed multidrug resistance.

**Figure 1:** (a) Clinical photograph showing eyelid edema and inflamed canalicual mucosa pouting through the punctum (arrow); (b) Smear showing gram-positive branching filamentous organisms, gram-positive cocci in short chains and pairs and numerous gram-negative bacilli (arrows) throughout (Gram stain, ×100); (c) Confluent alpha hemolytic pin point colonies at the site of inoculation on blood agar; (d) Identification of the organism as *Sphingomonas paucimobilis* by Vitek 2 Compact identification system

**Table 1: Clinical and microbiological profile of unusual organisms isolated in our series of patients with canaliculitis**

| Organism isolated               | Age/sex | Duration (months) | OD/OS | Upper/lower | Symptoms                        | Signs                  | Canalicual contents | Coinfection               | Antibiotic susceptibility | Comment                      |
|--------------------------------|---------|------------------|-------|-------------|--------------------------------|------------------------|---------------------|------------------------|---------------------------|------------------------------|
| *Sphingomonas paucimobilis*     | 49/male | 3                | OS    | Lower       | Watering                       | Concretions            |                     | *Streptococcus* species, *Actinomyces* species | Ch, Cft, O, - Ga, Mo, Ci, Ge, PT, I, Co |                              |
| *Myroides species*             | 9/male  | 3                | OS    | Upper       | Discharge                       | Pus, concretions       |                     | *Staphylococcus aureus* | Ch, Cfu, Ak, Ge, PT       | AC, O, Ga, Mo, Ci           | Intermediate to Cft, 1, Multi-drug resistant |
| *Brucella melitensis*          | 58/male | 12               | OD    | Lower       | Watering, discharge             | Pus, concretions       |                     | *Actinomyces* species, *Staphylococcus epidermidis* | Ch, AC, PT, Cfu, O, Ge, I, Co | Ga                          | Possible risk factor: Occupational exposure to cattle |
| *Leuconostoc species*          | 80/male | 1                | OD    | Lower       | Watering, discharge             | Debris                 |                     |                        | Ch, Cfu, V, O, Mo, Ci     | Intermediate to Ga         | Possible risk factor: Old age |

Ch=Chloramphenicol; Cfa=Cefazolin; Cft=Cefazidime; Cfu=Cefuroxime; V=Vancomycin; O=Ofloxacin; Ga=Gatifloxacin; Mo=Moxifloxacin; C=Cliprofloxacine; Ge=Gentamicin; Ak=Amikacin; AC=Aminocillin clavulanic acid; PT=Piperacillin tazobactam; I=Imipenem; Co=Colistin; OD= Oculus dexter; OS= Oculus sinister
Case 3
A 58-year-old male, a farmer by occupation presented with persistent watering and intermittent discharge for 1 year. He had had multiple consultations earlier and was treated with topical antibiotics. Ocular examination showed edema of the right lower eyelid localized to the medial aspect with a pouting punctum. Canalicular curettage revealed the presence of pus and concretions which were sent for microbiological evaluation. Gram’s stain of the smear showed Gram-positive branching filamentous organisms and Gram-positive cocci in clusters. Nonhemolytic nonpigmented small gray colonies [Figure 3] grew on blood agar. These were identified as *Brucella melitensis*. *Staphylococcus epidermidis* and *Actinomycetes* were also isolated from culture. The organisms were sensitive to chloramphenicol [Table 1].

Case 4
An 80-year-old male presented with watering and discharge from his right eye for 1 month. On examination, mild lower eyelid edema and matting of lashes with the discharge were noted. There was mild edema at the site of the punctum [Figure 4]. A diagnosis of canaliculitis was made and on curettage, debris was expressed from the lower canaliculus. No pus or concretions were present. Gram-positive cocci were seen in pairs and chains admixed with polymorphonuclear cells on the smear and culture on blood agar revealed small smooth round gray colonies which were identified as *Leuconostoc* species with a favorable sensitivity profile [Table 1].

Management
None of our patients were immunocompromised and all were in good systemic health. Among possible factors predisposing for infection were occupational exposure to cattle in case 3 and old age in case 4. All the patients underwent canalicular curettage and treated with topical chloramphenicol. Microbiological sampling, culture, and interpretation were in accordance with institute laboratory norms. Vitek 2 Compact identification system (Biomerieux, NC, l’Etiole, France) was used for identification of microorganisms in the cases 1–3 and *Leuconostoc* in case 4 was identified with biochemical tests. Kirby Bauer disc diffusion method was used to determine antibiotic susceptibility. All the organisms were susceptible to chloramphenicol and *Myroides* species was found to be multi-drug resistant. All the patients were free of symptoms on follow-up visits at a median follow-up of 6 weeks.

**DISCUSSION**
Canaliculitis accounts for about 2% of lacrimal disorders and...
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Table 2: Epidemiology and clinical relevance of unusual organisms isolated in our series of patients with canaliculitis

| Organism isolated          | Morphology | Taxonomy               | Biochemical properties          | Habitat | Human infection                                      | Ocular infection                                      | Reports of canaliculitis in literature |
|----------------------------|------------|------------------------|--------------------------------|---------|-----------------------------------------------------|-------------------------------------------------------|----------------------------------------|
| Sphingomonas paucimobilis   | Gram negative cocobacilli | Sphingomonadales        | Aerobic, slowly motile          | Water   | Opportunistic pathogen: bacteremia in immunosuppressed | Keratitis Endophthalmitis Canaliculi                | Gogandy et al. (2015): 4/101 culture positive cases of canaliculitis |
| Myroides species           | Gram negative bacilli      | Flavobacteriaceae       | Nonmotile                       | Soil    | Soft-tissue infections, catheter-related infections, endocarditis | Canaliculitis                                        | Ali et al (2015): Only report of myroides isolated from canaliculitis |
| Brucella melitensis        | Gram negative cocobacilli | Brucellaceae            | Nonmotile, nonfermenter Oxidase and catalase positive | Infected cattle harbour organisms in mammary glands and reproductive tract | Transmission of infection from infected animals to human through | Kerato-conjunctivitis, uveitis, retinal abscess and vasculitis, endophthalmitis, optic neuritis, dacyroadenitis | None |
| Leuconostoc species        | Gram positive cocci in pairs or short chain | Leuconostocaceae                | Gas forming                      | Various foodstuffs; can colonize skin and gastrointestinal tract | Opportunistic pathogen: Bacteremia, catheter-related infections, urinary tract infections, meningitis, osteomyelitis in immunosuppressed | Endophthalmitis                                       | None |

Figure 4: Subtle lower eyelid edema and discharge in the patient with Leuconostoc infection

misdiagnosis of the condition ranges from 33% to 100%.[^1-6] The most common clinical symptoms include tearing, discharge, swelling and less often pain, or none at all.[^1-5] Clinical signs which point at the diagnosis of canaliculitis include canalicular edema, pouting punctum, and expression of discharge on concretions by pressure over the canaliculus.[^2,3]

Canaliculitis has a slight female preponderance with the lower canalicus being more frequently involved.[^1] The female preponderance is presumed to be due to a combination of hormonal and lifestyle factors such as the use of cosmetics.[^2,3] All the four patients in our series were male. While canaliculitis can affects individuals at any age the mean age at diagnosis lies in the sixth decade.[^1,2] Childhood canaliculitis is rare with few reports in English literature.[^7] Park et al. reported canaliculitis with isolation of Actinomycetes in a 5-year-old child on treatment with oral steroids for idiopathic thrombocytopenic purpura but there is not enough evidence implicating immunosuppression as a risk factor for canaliculitis.[^7] The minimum age reported in two large series reported by Kaliki et al. and Gogandy et al. were 8 and 10 years, respectively.[^2,3]

There appears to be shift in the microbiological spectrum of organisms in primary canaliculitis with recent large series reported by Kaliki et al. and Gogandy et al. showing predominance of Streptococci and Staphylococci species.[^2,3] Gram-negative bacilli such as pseudomonas are known to be more common in punctal plug and canicular stent-related infections.[^13]

Sphingomonas paucimobilis as the name implies is a slowly motile gram-negative bacillus that has been isolated infrequently in primary canaliculitis.[^4] Systemic and ocular infections with opportunistic pathogens such as Leuconostoc species and Sphingomonas paucimobilis are known to occur in the setting of immunosuppression.[^8-10] Interestingly, we did not find a history of use of punctal plugs or canicular stents or immunosuppression in the case 1 with Sphingomonas infection.

Myroides, isolated in childhood canaliculitis in this series, is not a part of human flora and inhabit water or soil.[^11] Ali et al. reported an isolated case of Myroides associated canaliculitis showing resistance to chloramphenicol, cephalosporins, and penicillin.[^11] Myroides isolated in our patient was resistant to fluoroquinolones, ceftazidime, imipenem, and penicillins.

Ocular brucellosis has been reported in chronic systemic brucellosis, in the form of kerato-conjunctivitis episcleritis,
uveitis, dacryoadenitis, retinal vasculitis, and optic neuritis. Postulated mechanisms include direct invasion of ocular structures by the pathogen or development of immunological reaction to the bacterium. In either case, the systemic infection is the source and the organism is not known to colonize ocular surface or skin. Apart from our patient being 80 years old, no systemic predisposing factors were noted. Reports of ocular involvement by Leuconostoc are limited to two case reports of endophthalmitis one following an eventful cataract surgery and another following intravitreal ranibizumab injection. Both the strains were resistant to vancomycin and despite early intervention in both cases, one patient had final vision of hand movements and other patient’s eye deteriorated to phthisis. Leuconostoc thus can have a dreadful outcome following intraocular surgery or infection. We herein report the first case of canaliculitis with isolation of Leuconostoc species and emphasize the importance of complete cure and reviewing microbiological culture in canaliculitis, more so before planning any intraocular surgery.

Concretions that were earlier thought to be specific to Actinomycetes have also been reported to occur with, but not limited to Staphylococcus, Streptococcus, Hemophilus, Pseudomonas, Sphingomonas, and Gemella. Infection from concretions, Ali et al. also reported the presence of concretions. Myroides and Brucella in our patients showed the presence of in canaliculitis with Myroides isolation [Table 2].

Management of canaliculitis has been multi-faceted with reasonable success rates reported for each of the procedures described in different case series. Large series show curettage is effective in primary canaliculitis and prevents further recurrences. The advantages of curettage include decrease in organismal load, improved penetration of antibiotics, and the availability of specimens for microbiological evaluation to identify and determine antibiotic susceptibility. Punctal dilatation and expression as described by Kaliki et al. is less invasive procedure but had higher (40%) episodes of recurrent canaliculitis. Conservative management by irrigation with antibiotics, described by Mohan et al. was reported to be effective. Thus, conservative and/or punctal dilatation and expression may be useful as the first line of therapy in most primary canaliculitis, canicular curettage is the preferred management modality for recurrent disease.

Culture positivity in canaliculitis has improved over time with recent large case series on canaliculitis showing culture positivity range from 78% to 91%. Freedman et al. reported no organisms or non-specific organisms in 30% of the canaliculitis. This is likely to be a consequence of advances in microbiological techniques over time.

In summary, this short case series documents for the first time isolation of Brucella melitensis and Leuconostoc in primary canaliculitis. We also report the first case of Myroides species from childhood canaliculitis. Sphingomonas paucimobilis remain an uncommon isolate in primary canaliculitis.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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