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The Lacrimal Drainage System

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Patients with symptoms associated with the lacrimal system commonly present to their physician's office. The anatomical and physiological integrity of the lacrimal drainage pathways are important components of the proper functioning eye and periocular structures. This inaugural issue of *Ophthalmology Rounds* will focus on three cases that emphasize important issues related to the lacrimal drainage system. The first case presents an evaluation of a patient with epiphora and a patent lacrimal system and discusses treatment options. The second case relates to the evaluation and management of epiphora following retention and/or migration of a punctal plug. The third and final case presents a preoperative cataract patient without epiphora, but with an obstructed nasolacrimal system.

Case 1: Functional obstruction

The role of dacryocystography

A 21-year-old Caucasian female presented to her family practitioner with a 3-month history of a watery right eye with a small amount of discharge in the morning. She was treated unsuccessfully with antibiotic eye drops and referred to her general ophthalmologist. On examination, she had no manifestations of external ocular disease and syringing of the tearduct revealed 100% patency. There were no other symptoms other than tearing, apart from a mild discharge on awakening. She was given lubricating eye drops and asked to return 3 months later. The symptoms and findings were the same at that time, with 100% patency to syringing of the lacrimal system. She was referred to the lacrimal service for further evaluation.

The patient revealed a 7-month history of a watery right eye with no symptoms of itchiness, irritation, or grittiness. There was no discharge at this point in time. There were no previous ocular or systemic diseases and no allergies. The external ocular examination was completely normal, as were the eyelid and punctal examinations and the nasal endoscopic examination. Syringing of the tearduct revealed 100% patency. Examination of the contralateral asymptomatic side was completely normal.

The patient complained bitterly of unilateral tearing, and therefore, it was thought that further examination was necessary. A dacryocystogram was performed to determine whether there was any stenosis within the system that might be decreasing the flow of tears through the patent system. The dacryocystogram on the left side was completely normal but, on the right side, a virtually complete obstruction was visualized with a large prestenotic dilation of the lacrimal sac. It was only on later films that a small trickle of the contrast material through the

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Figure 1: Dacryocystogram with stenotic right sac-duct junction with pre-stenotic dilatation of sac

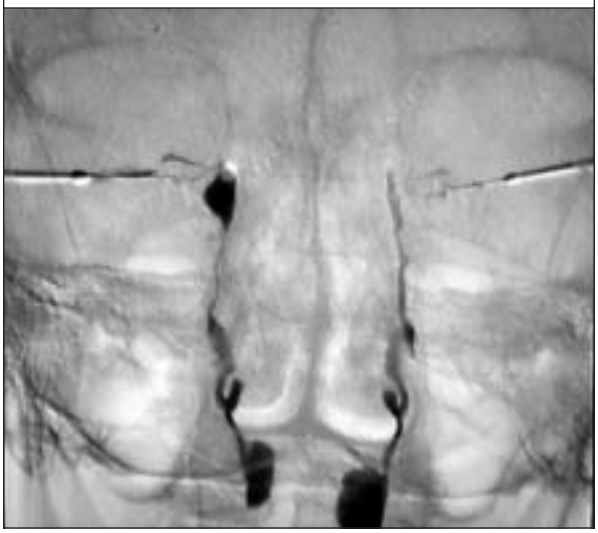

Figure 2: Stone within sac-duct in Figure 1

patent lacrimal system into the nose could be visualized (Figure 1). It was felt that with the previous finding of 100% patency to syringing and with visualization of a very tight stenosis at the sac-duct junction on dacryocystography, there might be a "flap-valve defect" at the sac-duct junction since the most likely etiology in a young female is a lacrimal calculus. The impression was that this calculus was probably mobile, which would explain the finding of clinical patency on syringing.

On the basis of her symptoms and dacryocystography findings, a dacryocystorhinostomy was planned. At surgery, an enlarged lacrimal sac containing 2 stones was found; one was embedded within the naso-lacrimal canal (Figure 2). Postoperatively, the lacimal system was 100% patent and the patient was completely relieved of her tearing symptoms.

Functional obstruction in a patient with epiphora

The term "functional obstruction" has been used to describe the patient with epiphora and a patent lacrimal system on syringing. An accurate diagnosis of the pathology is mandatory to determine the appropriate treatment. Hypersecretion of tears due to external ocular disease or a central abnormality must be ruled-out and, before incriminating the lacrimal drainage pathways, eyelid and/or punctal abnormalities (with or without facial palsy) must be excluded. In addition, a careful nasal examination (ideally with an endoscope) will rule-out a drainage problem due to a nasal abnormality. Syringing will determine if the system is completely patent, completely obstructed, or partially patent. In younger patients, tear secretion is significantly greater than in older patients (ie, a 20-year-old patient has 5 times the tear secretion of an 80-year-old patient). Therefore, even an incomplete obstruction within a patent system may be significant enough to cause a younger patient to experience epiphora. This situation is even more suspicious if the symptoms are unilateral. Dacryocystography with intubation, injection of a contrast material (usually a water-soluble, minimally viscous agent) and subtraction (usually digital) can highlight a small stenosis and demonstrate a proximal dilatation. A stone may produce a filling defect or deflection of the ribbon of contrast.

For the patient in Case 1, dacryocystography was performed by a slow injection through a portal longer than the usual cannula, with an agent that was more viscous than saline. The procedure was able to highlight the stenosis at the sac-duct junction and beautifully demonstrate the enlarged pre-stenotic dilatation of the lacrimal sac. The stones were not observable.

The investigation of a "functional obstruction" in this patient directed the appropriate management, which was a routine dacryocystorhinostomy (DCR). A survey of members of the American Society of Ophthalmic Plastic and Reconstructive Surgeons about managing a functional obstruction produced varied responses,

including performing a DCR, probing with tubes, a Jones tube insertion, punctoplasty, lid tightening, etc. As demonstrated in this patient, however, it is reasonable to investigate further with imaging procedures such as a dacryocystogram that can provide anatomical information. In this way, appropriate treatment can be instituted.

The utility of dacryocystography

In over 2000 lacrimal cases over the past 2 years, we have performed 880 DCRs. We have utilized dacryocystography in 47 patients (2.35% of epiphora cases) to provide more information than could be obtained on routine examination of the puncta, lid, lacrimal system (with syringing and other clinical functional tests), and nasal system. A dacryocystogram is relatively inexpensive to perform and, when utilized, has helped to direct treatment.

Conclusion

With an appropriate clinical examination, it is usually possible to define the abnormality in the epiphora patient with a system patent to irrigation. However, if the clinical examination is insufficient to reach a diagnosis, further investigation with dacryocystography is a useful and cost-effective tool for diagnosing an abnormality within the lacrimal drainage system.

Case 2: Retained and/or migrated punctal plugs

A 35-year-old Asian female presented with a watery right eye and some degree of grittiness. After unsuccessful treatment with lubricants, an intracanalicular Herrick plug was placed within the lower canaliculus in an attempt to treat the "dry eyes." Subsequently, not only did her symptoms not improve, the tearing became worse. She was referred to our clinic by her family practitioner for management of the epiphora. On examination, the patient had a completely asymptomatic external lacrimal and nasal system on the contralateral side. On the symptomatic side, however, she was found to have complete obstruction when irrigation was performed through the lower canaliculus, with 100% reflux through the upper canaliculus. On advancing the cannula, a "hard-stop" could be felt approximately 9 mm from the punctum. No hard stop was felt on advancing the probe through the upper canaliculus. Clinically, there appeared to be a lateral common canaliculus obstruction. There was also the possibility of an incomplete obstruction of the lower canaliculus close to its junction with the common canaliculus. In an attempt to determine whether the plug was still in place, an ultrasound biomicroscopy (UBM) was performed. The UBM suggested that the plug was still present, but quite distal in the lower canaliculus, presumably at its junction with the common canaliculus.

In our experience with retained and/or migrated punctal plugs in the past, if the patient requests treatment for the epiphora, it is necessary to perform a DCR and remove the punctal plug via an external approach, which allows exploration of the common canaliculus.

An attempt was made to dilate and 3-snip the lower punctum and to extract the plug from the canaliculus, but it was unsuccessful. An external DCR provided adequate visualization to remove the plug embedded in the common canaliculus. The DCR was completed uneventfully.

Hazards of punctal plug insertions

Punctal plugs should be inserted as a last resort when treating a dry-eyed patient, once all other noninvasive modalities have been utilized. Intracanalicular plugs may cause a reaction within the system and lead to obstruction and inflammatory granulomata. A plug placed within the punctum may migrate down the canaliculus and produce symptoms of epiphora and/or discharge. UBM is a useful tool to determine whether the obstruction in the system is due to the plug, a secondary obstruction induced by the plug, or both. For the patient who wants treatment for the epiphora, if the plug is quite proximal and close to the punctum, a 3-snip procedure of the punctum can be attempted to extract the plug through the punctum. However, if the plug and/or obstruction is more distal within the system (closer to the common canaliculus), an open DCR is the appropriate treatment.

Conclusion

The insertion of a punctal plug and/or an intracanalicular plug is an invasive procedure

with potential risks and may result in secondary epiphora and an unhappy patient requesting treatment. Punctal plugs are often visible within the embedded canaliculi with UBM. The epiphora can usually be cured by removing the plug and treating any obstruction.

Case 3: The preoperative cataract surgery patient with an obstructed tearduct

An 81-year-old Caucasian male presented to his general ophthalmologist with decreased vision in both eyes, more significantly on the left side. Cataracts were diagnosed and he was booked for a left cataract operation. The patient also had mild blepharitis and complained that he had slightly more discharge on the left side than on the right. The ophthalmologist irrigated the lacrimal system and found it to be completely obstructed. The patient had no symptoms of epiphora and only mild discharge. He was referred to our lacrimal service to determine whether DCR should be performed before cataract surgery to minimize the theoretical possibility of postoperative endophthalmitis.

On examination, the patient was found to have very mild symmetrical blepharitis. Digital pressure over the lacrimal sac revealed no regurgitation of mucous through either punctum. When the lacrimal system was irrigated, a complete obstruction was found with a significant degree of mucopurulent regurgitation from the lacrimal sac. The patient denied any history of symptomatology that was suggestive of any form of dacryocystitis. Advancing the cannula through the canaliculus revealed a "hard stop" (with the cannula hitting against the bone of the lacrimal fossa), suggesting an obstruction within the lacrimal sac itself. The question subsequently arose about whether the patient should have a DCR before his cataract operation. After discussions between the patient and his ophthalmologist and, given the fact that he was a healthy 81-year-old who was not taking any systemic medications, a routine outpatient external DCR under local anesthesia was performed. The patient had a completely patent system to irrigation following the lacrimal surgery and was referred back to his general ophthalmologist for cataract surgery. The general ophthalmologist treated the mild blepharitis with lid scrubs and preoperative antibiotics and the patient had an uneventful cataract procedure and a normal postoperative course.

The preoperative cataract patient – Is lacrimal investigation necessary?

There has been much discussion regarding the role of preoperative antibiotics in the prevention of post-cataract surgery endophthalmitis. There is also great controversy as to whether antibiotics are necessary and, if so, which one should be given, by what route, and for how long. Then, there is the question of intra-operative antibiotics and postoperative antibiotics in an attempt to prevent postoperative endophthalmitis. Although endophthalmitis following cataract surgery is extremely rare, it is a devastating event for both the patient and for the surgeon, and it is a situation that should be prevented. The lacrimal sac lies quite close to the surgical site for a cataract operation. In theory, bacteria from within the sac may contaminate the surgical field and establish an intraocular location. An obstructed lacrimal sac may harbour bacteria that may escape from the sac and contaminate the palpebral aperture, especially if pressure over the sac occurs at the time of the cataract operation. The most common commensal organisms within the lacrimal sac are *Staphylococcus* and *Streptococcus pneumoniae* and, certainly, these are among the most common causes of endophthalmitis. The obstructed sac may also harbour Gram negative bacteria, some of which have also been found in endophthalmitis patients.

Cataract surgery is often performed in the elderly who have decreased tear secretion; therefore, these older patients may have no symptoms of epiphora, even with a blocked tearduct. How often are blocked tearducts found in older people? Up to 20% do not have complete patency to syringing based on a study we performed on patients booked for cataract surgery. What is the best way to

Table 1: Occult lacrimal obstruction – treatment in the asymptomatic patient

- **Punctum**
  - dilate
  - 3-snip
- **Canaliculus**
  - if no discharge – cataract surgery
  - if discharge – CDCR (try to avoid Jones tubes)
- **Common canaliculus**
  - if lateral + no discharge – cataract surgery
  - if discharge – CDCR
  - if medial – CDCR optional
- **Sac obstruction**
  - if discharge – DCR
  - if no discharge – DCR optional

DCR = dacryocystorhinostomy
CDCR = conjunctivodacryocystorhinostomy

proceed with these patients since, surely, they do not all need DCRs? The following protocol is suggested: if the patient has symptomatic epiphora and wishes treatment, it makes sense to perform lacrimal surgery before cataract surgery. If the patient is asymptomatic, however, evaluation of the site of obstruction is extremely important (Table 1). If the obstruction occurs within the canaliculi or common canaliculus (as long as there is no canaliculitis), bacteria are less likely to stagnate because these are small-caliber channels. For this reason, a lacrimal operation is generally not performed and the patient is advised that there is only a very slight increased chance of intraocular infection due to canalicular obstruction during cataract surgery.

I am not aware of any patients who have developed endophthalmitis in this situation. However, a more rigorous routine of preoperative antibiotics might be advised. If an obstruction is present in the lacrimal sac in conjunction with a regurgitating mucocele, a DCR should be performed. However, if there is an obstruction in the sac with no mucocele clinically present, it is possible (as in the patient in this case report) to have a sac full of mucopurulent material, even if there is no regurgitation on pressure over the sac. If the sac had not been irrigated preoperatively, there is no way that this diagnosis would have been made. Therefore, should the lacrimal system be irrigated before cataract surgery? Certainly, as in this patient with the sac full of pus, a DCR before cataract surgery would be prudent. If the sac is completely obstructed, but the irrigation is completely clear and the patient is asymptomatic, then (just as with a canalicular obstruction), the patient can proceed with cataract surgery. However, more aggressive preoperative antibiotic prophylaxis is indicated with the patient having been informed that there is only a slightly increased risk of postoperative endophthalmitis.

Suggested investigation of the lacrimal system before cataract surgery

History of epiphora

If the patient has epiphora due to lacrimal obstruction and wishes to be treated, it should be done before cataract surgery.

Palpation of the tearsac

If a mucocele is present – either regurgitating or nonregurgitating – even if the patient is asymptomatic, a pre-cataract surgery DCR would be prudent.

Should the tearsac be irrigated?

In most cases (except for the more unusual findings in this case report), even with a blocked tearsac and no muco-pus reflux, the chances of endophthalmitis are very minimal.

Conclusion

In an attempt to prevent post-cataract surgery endophthalmitis, it is wise to think of the lacrimal system and at least ask if there are any symptoms of epiphora and to examine the lacrimal system by pressing over the tearsac. As far as irrigating the lacrimal system preoperatively, the situation of the patient in Case 3 (ie,"silent" mucous within the sac) may be a possibility. In this patient, we will never know if he might have developed endophthalmitis without first performing a DCR. Whether the lacrimal system is irrigated as part of the cataract work-up is up to the

surgeon, but certainly, thinking of the lacrimal system, taking a lacrimal history, and palpating the lacrimal sac are simple, noninvasive procedures that, in most cases, provide the necessary information. If the findings are inconclusive, then lacrimal irrigation is recommended.

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Upcoming Department Events

October 30, 2003
Visiting Professors Programme (VPP) –
Dr. John Chen, Montreal, Quebec
Current Therapy and Thoughts of Diabetic Macular Edema

November 6, 2003
VPP – Dr. Ivan Schwab, Sacramento, California
When the moon turns to blood

November 27, 2003
VPP – Dr. Thomas Liesegang, Jacksonville, Florida
Concerns of the Ophthalmology editor in 2003

December 5-6, 2003
Walter Wright Day *The Aging Eye*
Contact – Dr. Shaun Singer (Email: singer.s@rogers.com)

December 6, 2003
University of Toronto Alumni meeting in conjunction with Walter Wright

Note: The 2003/2004 Visiting Professors Programme (VPP) site address:
Toronto Western Hospital, West Wing, Room 401,
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Contact – Dr. Wai Ching Lam
(Email: waiching.lam@utoronto.ca)

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