The anatomy and diseases of the lachrymal passages / by W. Spencer Watson.

THE LACHRYMAL PASSAGES

W. SPENCER WATSON

THE

ANATOMY AND DISEASES

OF THE

LACHRYMAL PASSAGES

BY

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WITH LITHOGRAPHIC PLATE AND 10 ENGRAVINGS

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PREFACE.

THE following pages were written for the purpose of laying before the medical profession the results of the author's experience in a department of surgery which forms a connecting link between two specialities, to both of which he has given a large proportion of his professional life. He trusts that he has put into a readable form some practical deductions from experience, and also a clear and sufficiently elaborate account of the Anatomy and Functions of the Lachrymal Passages.

The advances of Surgery in this department have scarcely been so well recognised as they deserve, and hence the necessity for a reconsideration of the whole subject from the points of view of ophthalmic and throat specialism.

The author has to thank several of his professional friends, and especially Mr. Thomas Cooke for assistance in the Anatomical part of the work, and his son Mr. George Spencer Watson for the original lithographic illustrations of the Anatomy of the organs described.

7 Henrietta Street, W.

June, 1892.

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THE ANATOMY AND DISEASES

OF THE

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INTRODUCTORY REMARKS ON THE TERMS EMPLOYED BY VARIOUS AUTHORS AND OTHERS.

Watery eye is a very general term, popularly including all cases in which there is an overflow of tears, without reference to any theory as to its cause. The term *epiphora* expresses the same idea. The overflow may be the consequence either of excessive secretion or of defects in the excretory apparatus. *Lachrymation (larmoiement)* is employed rather loosely in the same sense and indicates only a symptom. Perhaps the best term for an overflow due to an impediment or obstruction in the excretory passages is *stillicidium lachrymarum*, and some authors, as for instance the late Mr. Soelberg Wells, use it exclusively in this sense (*Diseases of the Eye*, p. 609). The word *tearing*, used by Swanzy of Dublin, is objectionable in any sense. It is evidently a word of recent coinage, and is liable to be confounded with the present participle of the verb "to tear" (or lacerate). The gush of tears due to reflex irritation, as from the presence of a foreign body on the conjunctival surface, or associated with the photophobia of phlyctenular ophthalmia or scrofulous ophthalmia is best described as *reflex lachrymation*. This term may also be very fitly applied to the gush of tears due to irritation of the Schneiderian membrane by foreign bodies or pungent vapours or snuffs. For the emotional flow of tears the ordinary term *weeping* will suffice, though even this expression is sometimes popularly used for the *watery eye*, due to obstruction of the excretory passages. When there is excessive secretion of the lachrymal gland, from disease or local irritation, the case can

be described only by the term *hypersecretion of tears*, and the symptoms as *epiphora of glandular origin*. I believe this, however, to be a very rare condition, traceable, in some instances, to mental causes, and in others to diseases of an irritant kind in the nose and throat.

Dacryocystitis or inflammation of the lachrymal sac is equivalent in the chronic condition to *lachrymal mucocele* or *tumeur lacrymale*, and blenorrhœa in the purulent stage is expressed by the term *abscess of the sac*.

But some authors use the terms *mucocele* and *blenorrhœa* to describe the more chronic condition of distension of the sac by mucus, which is associated with strictures or obstructions in the sac or nasal duct. As there is chronic inflammation of the lining of the sac in these cases it is more convenient to include them in the general term *dacryocystitis*.

Pericystitis lachrymalis is a term indicating a condition often associated with dacryocystitis, and implying a subcutaneous inflammation of the tissues immediately surrounding the sac.

Some of the anatomical terms have given rise to confusion in consequence of the use of several synonyms for a single part or organ. The following serve as examples:—*tendo oculi*, *tendo palpebrarum*, *internal palpebral ligament*, *ligament angulaire interne*, *tendon directe de l'orbiculaire* (*see* Ludovic, Hirschfeld and Leveille), *anterior fasciculus of the ligament palpébral médial* (De Wecker and Landolt, tome i., p. 138), all terms indicating the same structure. While *Horner's muscle*, *tensor tarsi*, or *musculus sacci lachrymalis* are also synonyms.

Reflected tendon of the orbicularis is equivalent to *posterior fasciculus of the ligament palpébral médial* (De Wecker and Landolt, tome i., p. 138).

The *lachrymal sac* is described by H. Power as the *lacrimal sac*. Both ways of spelling are equally correct. Messrs. Robin and Cadiat (whose monograph in the *Journal de l'Anatomie et Physiologie*, 1875, is most valuable) include the *sac* and *nasal duct* in one term—*naso-lacrymal canal*. The same authors describe the *canaliculi* as the *canal lacrymal supérieur* and *canal lacrymal inférieur*. This is very likely to lead to confusion. Most French authors call the canaliculi *conduits lacrymaux*.

SECTION I.

The Anatomy and Functions of the Lacus Lachrymalis, the Caruncle, and the Lachrymal Passages.

The secretion of the lachrymal gland (a fluid consisting of water with one per cent. of common salt and some yellow extractive matter) passes from its excretory ducts over the conjunctival surfaces to the *puncta lachrymalia* at the summits of the papillæ lachrymales, by which minute apertures commence the *canaliculi*. The tears pass through the *lachrymal sac* and *nasal duct* into the inferior meatus of the nose, where the lachrymal channels terminate by a semi-valvular or slit-like opening, either in its angular roof or on its outer wall.

The tears are, in health, secreted continuously in a quantity, small indeed, but being mixed with the conjunctival mucus, sufficient to lubricate and keep constantly moist the entire surface of the conjunctiva. They are partly dried up in their passage over the cornea and partly absorbed. The remnant finds its way to the hollow at the inner canthus, called the *lacus lachrymalis*, whence it is taken up by the *puncta* and *canaliculi*. The tears are poured out in much greater abundance under the influence of emotion, and as a result of reflex irritation, as when there is any foreign body resting on the conjunctiva or cornea, or when these parts are inflamed from any cause. A copious flow of tears is also caused when the Schneiderian membrane is irritated by pungent vapours, or by mechanical injury. Pungent substances, such as mustard, taken by the mouth, have also the effect familiar to most people of causing the eyes to water, from the pungent volatile oil passing into the nostrils through the posterior nares.

The **lacus lachrymalis** and the **caruncle** (caruncula lachrymalis) play a prominent part in the conveyance of the tears towards the nose.

The separation of the internal extremities of the soft parts of the eyelids is continued for about 3‴ beyond the termination

of the tarsal cartilages, and at the spot marked by the *puncta* the free edge of the eyelid changes suddenly from a plane to a rounded surface, and the margins of the *lacus* shelve gradually into the mucous membrane on the ocular side and into the skin on the other aspect. This portion of the palpebral cleft is occupied in its centre by the caruncle and its external boundary is the *plica semilunaris*. The *caruncle* is an ovoid or triangular, reddish, or yellowish-white body consisting of a process of the conjunctiva in which ten or twelve sebaceous glands are embedded. From these glands spring some extremely fine hairs, too small to be visible to the unassisted eye. Each gland consists of several lobules, which converge and open into hair-follicles.

The **canaliculi lachrymales** are the minute channels beginning at the puncta and terminating at the lachrymal sac. Each begins in the form of a little pear-shaped ampulla, the base of which is turned towards the adherent border of the corresponding eyelid, and the apex towards its free border, viz., at the punctum. Each ampulla is hollowed out of the lachrymal papilla or tubercle, whence the channel is continued inwards, and a little backwards, the lower passing horizontally and the upper one obliquely downwards. Arrived at the point at which the tendo palpebrarum bifurcates, and immediately behind this point, the two channels unite into a common duct, which, continuing inwards and backwards, opens into the sac at a point corresponding to the junction of its upper with its second fourth. These canals have a single tunic lined with pavement epithelium, the outer surface of the hollow cylinders being in direct contiguity with the striated fibres of Horner's muscle, through which they pass (Robin and Cadiat, *Journal de l'Anatomie et de la Physiologie*, 1875). The epithelium of the canaliculi is not ciliated; that of the sac and duct is ciliated as in the nose. Merkel (*Handbuch der Gesammte Augenheilkunde*) denies this, and is supported by Robin and Cadiat.

The **lachrymal sac** is a nearly cylindrical membranous channel, occupying the osseous groove formed by the os unguis and the ascending process of the superior maxillary bone. It is situated immediately behind the tendo palpebrarum, which is adherent to its anterior wall about 3‴ below its upper dome-shaped extremity. Its postero-external wall is covered partly

by the reflected tendon of the orbicularis (to which, however, it is not adherent) and which sends upwards and downwards fibrous expansions which are really a part of the reflected tendon. This arrangement is shown at *a* in fig. 1 of the plate, from a drawing of a dissection made by Mr. Thomas Cooke. Mr. Cooke points out that the reflected portion of the tendon at its insertion is much wider than the *tensor tarsi*, which,

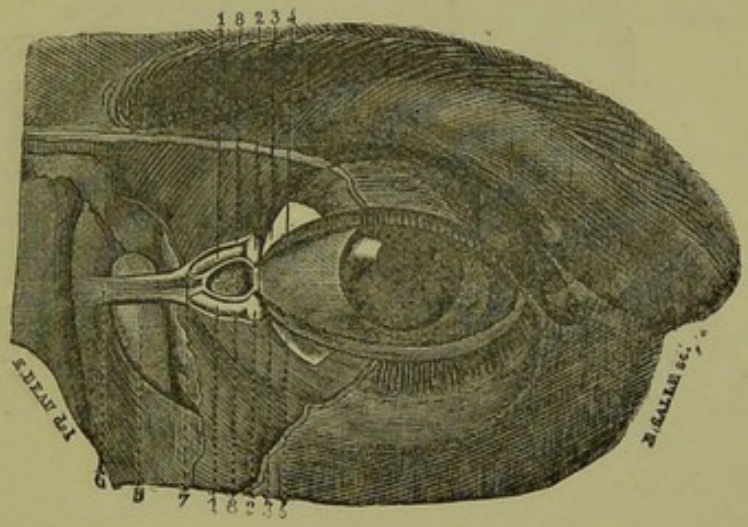

FIG. 1.—The puncta lachrymalia, the canaliculi and the lachrymal sac. The relations of the canaliculi and of the sac with the tendon of the orbicularis (used by permission of Prof. Sappey from an illustration in his work *Anatomie Descriptive*, Paris, 1872).

1 1. The canaliculi; 2 2. The *Ampullæ* constituting the commencement of the canaliculi and the orifices or puncta lachrymalia through which the tears pass to these *ampullæ*; 3 3. The tarsal cartilages, superior and inferior, of which the internal part has been denuded in order that the relations of the puncta to these cartilages may be seen; 4 4. The ocular portion of the cartilages; 5. The *lachrymal sac*; 6. The tendon of the orbicularis (or internal palpebral ligament) the lower border of which crosses the sac at the point of union of the upper third with its two inferior thirds; 7. The point of bifurcation of this tendon, corresponding to the point of junction of the two canaliculi; 8 8. Branches of bifurcation of this tendon forming a fibrous sheath round each canaliculus the anterior wall of which has been dissected off to show the canaliculi.

arising behind the tendon from the posterior lachrymal crest, crosses the latter on its way to the inner canthus where it divides into an upper and lower branch (*see* Plate, opposite p. 10, *b*, fig. 1).

The relations between the sac, the reflected tendon of the orbicularis and the tensor tarsi are shown in Plate, figs. 2

and 3. The condition of the parts are shown in fig. 1 with the eye open, and in fig. 2 when the eye is closed. The inferior

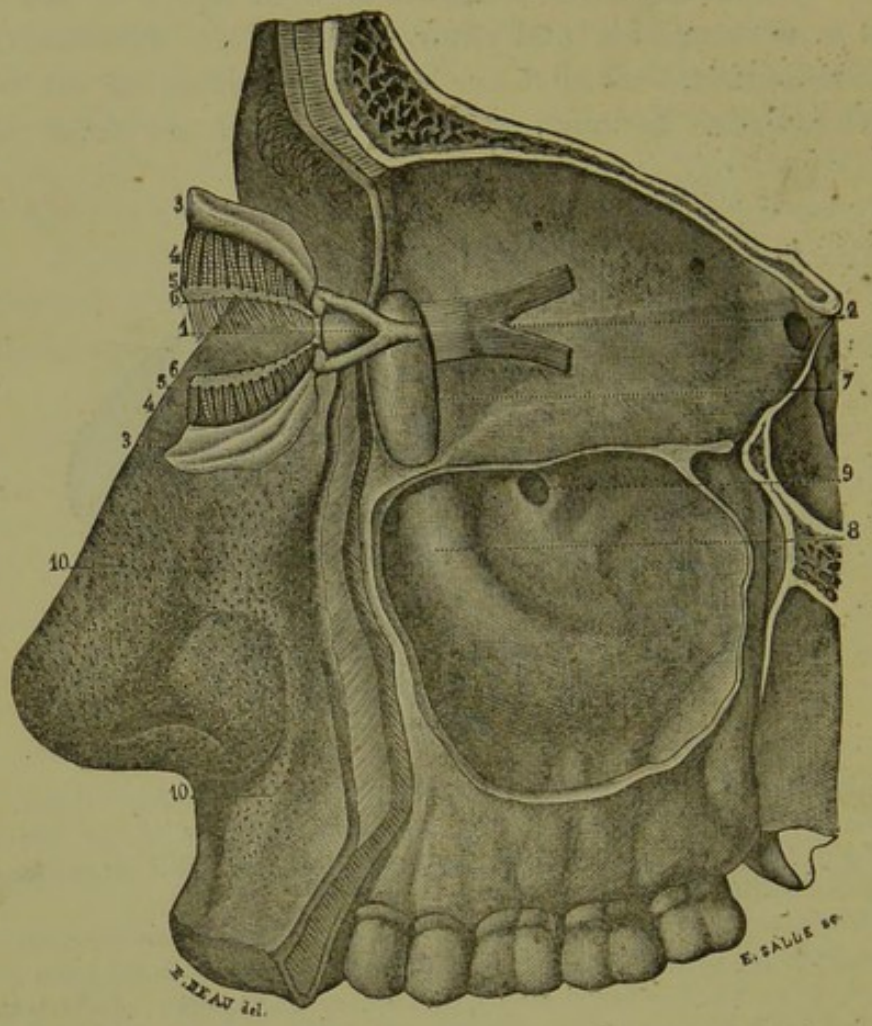

FIG. 2.—The common portion of the two canaliculi—Horner's muscle. The sac and the prominence formed by the nasal duct on the inner wall of the Antrum of Highmore (used by permission of Prof. Sappey from his work entitled *Anatomie Descriptive*, Paris, 1872). 1. The common portion of the canaliculi opening into the lachrymal sac at a point corresponding to the union of the posterior third with the two anterior thirds; 2. The muscle of Horner inserted behind the crest of the os unguis and dividing into two branches corresponding with the two canaliculi; 3 3. The palpebral conjunctiva; 4 4. The tarsal cartilages and Meibomian glands; 5 5. The posterior lip of the free border of the eyelid and the openings of these glands; 6 6. The anterior border of the palpebral margin and the eyelashes; 7. The lachrymal sac; 8. The prominence formed by the nasal duct on the inner wall of the antrum, and the swelling of this prominence along the position of the inferior meatus which seems to be simply an expansion of the nasal duct; 9. The orifice of communication between the antrum and the anterior or infundibuli-form part of the middle meatus; 10. The orifices of the sebaceous glands of the nose.

oblique is in relation to the lower part of the postero-external wall, and is sometimes attached to it as to a point of origin.

Robin and Cadiat (*Journal de l'Anatomie et de la Physiologie*, 1875) describe a network of veins of a cavernous character lying outside the mucous membrane and connected with the periosteum. The presence of this cavernous tissue seems to be somewhat intimately associated with the function of the sac in health and disease. When distended with blood it converts the channel into a mere chink, which is nevertheless sufficient for the passage of tears.

The direction of its channel is downwards with a slight inclination outwards and forwards (*see* Sappey's *Traité d'Anatomie Descriptive*, tome iii., p. 138, and Merkel's description in Wecker and Landolt, tome i., p. 138.)

The reflected tendon of the orbicularis is described by Merkel as the posterior fasciculus of the *ligament palpébral médial*, and is regarded by him as preventing all direct pressure upon the sac. The relations of the sac to this ligament, and the tendo-palpebrarum, and to Horner's muscle are difficult to describe, and are therefore represented in the lithographic plate, figs. 2 and 3, opposite to p. 10. The upper extremity forms a *cul-de-sac*, and its lower extremity is continuous with the **nasal duct.** This duct opens either in the upper angular roof of the inferior meatus by a rounded orifice, or on the outer wall of the meatus by a vertical slit; when the orifice is in the vault of the meatus, it is large, rounded, and infundibuliform, so that the tears then fall without obstruction, and by their own gravity on to the floor of the nose. When the lower orifice is situated on the outer wall of the meatus it is very small, and often difficult to find, even when injections are made through the canaliculi. The lower the orifice the smaller is its size. The lower part of the internal wall of the canal is not bounded by bone, but by a duplicature of mucous membrane, the lower free border of which limits the upper border of the aperture (H. Power, "On the Lacrimal Apparatus of the Eye," *Med. Times and Gaz.*, Nov. 3rd, 1883).

The dimensions of the lachrymal sac and nasal ducts respectively, in the dead body, are thus given by Messrs. Arlt and Weber (*Archiv für Ophthalmologie*, t. i. A. 2, p. 135, and *Klinische Monatsblätter*, 1863, p. 63).

	M. Arlt.	M. Weber.
Lachrymal Sac.		
Length	10 Mil.	12 to 15 Mil.
Depth (from back to front)	4 „	Depth 6 „
Width	4 „	Width 4 „
Nasal Duct.		
Length	10 to 16 Mil.	10 to 12 Mil.
Depth	1½ to 2½ „	Depth 4 „
Width	„ „ „	Width 3 „

These dimensions in the living subject would be rather less, as will be at once evident, if we consider how all the mucous membranes become shrunk and attenuated after death. Consequently, the width and depth of these canals must be taken as rather less than the figures above given would imply:—the length of the canals will be pretty much the same during life as after death.

According to my own measurements, the lachrymal sac varies in length from two-fifths to three-fifths of an inch, and the nasal duct from two-fifths to half an inch; so that the total length of the sac and duct together will be rather more than an inch in the larger specimens and rather less in the smaller. From the upper end of the sac to the floor of the nose is about one and a half inch in the adult of average size.

The variations of size and form of the features, and especially those of the nose, in different individuals, at different ages, and in different races of mankind, will cause corresponding variations of size and shape of the lachrymal sac and nasal duct. The channels thus described convey the tears, and perhaps some of the ordinary mucus, from the conjunctiva to the nasal fossæ.

The **lining membrane of the sac** presents transverse folds at several points, and one more prominent fold at its junction with the nasal duct. According to De Wecker it is studded with minute mucous glands, and similar glands are found in the nasal duct; but according to Professor Sappey the duct only is lined by these glands, the sac being absolutely without them, and Robin and Cadiat deny that there are any glands either in the sac or duct. The direction of the combined chan-

nel composed of the sac and duct is downwards, backwards, and a little outwards; the curve backwards and outwards being due to the deviation of the outer wall of the duct in those directions.

The orbicularis muscle. The orbital part (the peripheral or circumferential fibres) of this muscle is fixed only at the inner side of the orbit, where the fibres spring from the upper and lower margins and front surface of the tendo palpebrarum, from the nasal process of the superior maxillary and angular process of the frontal bone, and below the tendon from the orbital margin of the superior maxillary bone. From this origin they are directed outwards arching round the temporal aspects of the orbits, and merging into the other cutaneous muscles of those regions.

The internal or palpebral division has paler and finer fibres. They are fixed at both the outer and inner sides, viz., to the internal and external tarsal ligaments.

Dr. Wecker (*Maladies des Yeux*, tome i., p. 599) divides the palpebral part of the orbicularis into the **anterior and posterior lachrymal muscles,** the names implying an origin of the former from the front, of the latter from behind the lachrymal sac. The latter seems to correspond to Horner's muscle in origin, though it extends further along the margins of the eyelids. It arches under the curved lower border of the anterior muscle in such a way as to embrace the canaliculi, and so to reach the lower margins of the eyelids. The posterior lachrymal muscle serves to keep the edges of the tarsi accurately and closely applied to the surface of the eyeball, and also to press the tears towards the lacus.

Horner's (musculus sacci lachrymalis) or **tensor tarsi muscle** arises from the posterior lachrymal ridge on the os unguis, thence it passes to the internal canthus, where it bifurcates, and is inserted into each of the canaliculi. It therefore draws the canaliculi inwards and backwards. According to De Wecker's view this muscle forms part of the posterior lachrymal division of the orbicularis, while Sappey and others describe a reflected tendon of the orbicularis which arises from the lachrymal ridge of the os unguis, and regard Horner's muscle as a distinct band of fibres arising from the same ridge behind the reflected tendon of the orbicularis (De Wecker's *Maladies des Yeux*, tome i., part ii., p. 500). (*See* Diagram on Plate, facing p. 10, figs. 2 and 3).

The functions of the orbicularis and tensor tarsi (Horner's muscle) in relation to the lachrymal passages. The circumferential or orbital division of the *orbicularis* has no relations to the lachrymal sac, and can only in extreme and forcible closing of the eyes have any influence in directing the tears towards it. In the ordinary automatic winking movements of the eyelids its two other divisions play an important part. The automatic movements, though ordinarily unnoticed, are constantly going on at short intervals. Their chief object is that of clearing the surface of the eye from the tears which would otherwise accumulate or overflow. While the edges of the closing lids (chiefly the upper) sweep the tears downwards and inwards, the movement of the inner end of the tarsus towards the nose and the lifting forwards of the *tendo palpebarum* cause a dilatation of the lachrymal sac. At the same moment the puncta are drawn inwards and immersed in the fluid in the *lacus lachrymalis*. The result is that the tears pass into the canaliculi and thence into the sac. The capillarity of the canaliculi and the suction power of the dilating sac are the two forces which induce the downward flow of the tears. (*See* Diagrams on Plate figs. 2 and 3).

The *anterior lachrymal muscle* has the chief influence in closing the lids and drawing them towards the inner canthus. The act of closing them also brings them forwards, and with them the tendo palpebrarum. This movement necessitates the advance of the anterior and inner wall of the lachrymal sac, and is the source of its dilatation and consequent suction powers, which can produce only a downward flow. An upward flow from the nasal fossæ is prevented by the valvular folds in the sac and duct, and especially by the valvular termination of the nasal duct in the inferior meatus.

It has been proved experimentally that neither water nor air can be forced upwards from the nose through the normal nasal duct into the lachrymal sac. The opening of the eyelids restores the tendo palpebrarum to its naturally depressed position between the inner canthus and the nasal process of the superior maxillary bone, and with it the exterior wall of the sac recedes. These movements are brought about by the contraction of the *tensor tarsi* which also compresses the sac, when it is distended, and forces its contents downwards.

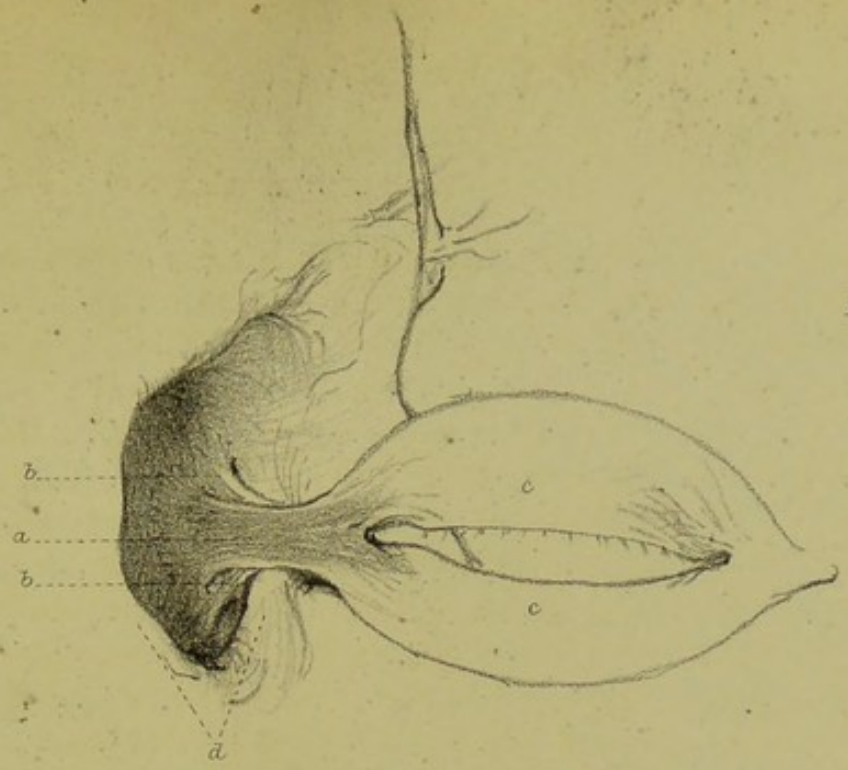

Fig. 1.

Fig. 2.

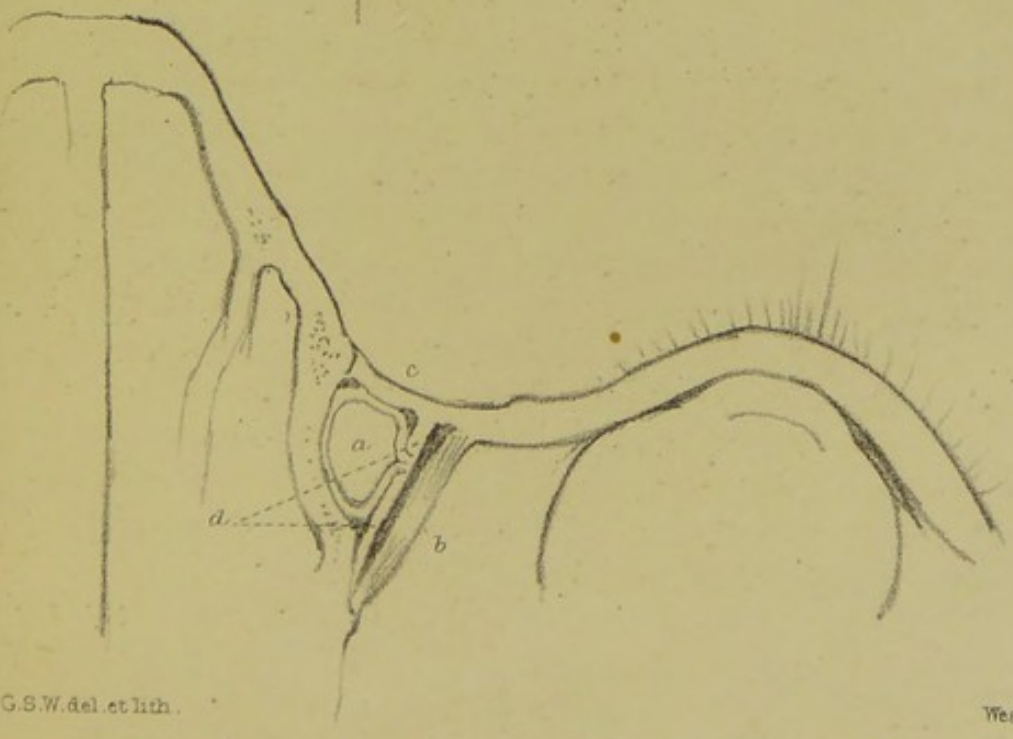

Fig. 3.

G.S.W. del. et lith.

West, Newman imp.

DESCRIPTION OF LITHOGRAPHIC PLATE.

FIG. 1.—A view of the inner wall of the right orbit, seen from the outer side:—*a*. *Horner's muscle* attached posteriorly to the posterior lachrymal crest, and dividing in front, to be inserted on the inner canthus. *b b*. The membranous attachment of the *reflected tendon* of the *orbicularis*, seen above and below the fibres of the *tensor tarsi*, and hiding from view the *lachrymal sac*. *c c*. The conjunctival aspect of the eyelids, which have been detached from the margins of the orbit. *d*. The margin of the orbit.

FIG. 2.—A diagrammatic horizontal section of the right eye. *a*. The cavity of the *lachrymal sac*. *b*. The *tensor tarsi* (Horner's muscle) contracted and drawing backwards and inwards the inner canthus. *c*. The *tendo-oculi* or *internal palpebral ligament*. *d*. The *reflected* tendon of the orbicularis. In this diagram the eye is represented with the eyelids open, and the *lachrymal sac* collapsed.

FIG. 3.—Transverse section of the same parts, the letters indicating the same parts in the state of "closed eye" and dilated *sac*.

As a difference of opinion exists as to the alternate dilatation and contraction of the sac it is necessary to examine the evidence for and against the statements above made. The first piece of evidence as to the suction power of the sac is that derived from observing the behaviour of a bead of pus in the skin orifice of a lachrymal fistula during the act of closing the eyes. It is generally noticed that the droplet recedes towards the sac during this movement. The current therefore must be downwards and this can only take place by a dilatation of the sac at the time. For the closed lids are exerting pressure on the contents of the lacus, and if this pressure also operated in compressing the sac, the tears would be prevented from entering it. The reverse, however, is the case, and the compression of the sac takes place only on the opening of the eye; its effect being to carry the tears downwards towards the nose. If, however, we suppose that the sac is compressed during the closure of the eyelids, and dilated when they are open, we are met with the objection that the *puncta* are in the latter action in a less favourable position for receiving the tears, for they are then drawn outwards, and applied to the ocular conjunctiva instead of being as in the closed eye turned inwards and immersed in the liquid accumulated in the *lacus*.

If we observe closely the internal canthus when the eye is suddenly and firmly closed it is clear that the internal palpebral ligament advances. It may be felt by the finger to do so, and even seen to advance in some cases. The *sac*, however, is so closely applied to the ligament that its anterior wall must necessarily advance with it. The posterior wall then being almost if not quite fixed by its fibrous adhesion to the lachrymal bone, there is no other conclusion but that the cavity is dilated at the level of the internal orifices of the *canaliculi*. The anatomy of the distribution of the posterior lachrymal muscle (Horner's musculus sacci lachrymalis) makes it probable that the fibres through which the *canaliculi* pass, act as compressors of these channels at the same time that they compress the sac*

* *Action of Horner's muscle.*—Merkel (Graefe, Saemisch, t. i., p. 70) describes a *medial palpebral ligament* including in that term the *tendo palpebrarum* and the *reflected tendon* of the orbicularis (its posterior lachrymal division). According to Merkel the disposition of the posterior band of this ligament in relation to the lachrymal sac, is such that it prevents pressure upon it whatever

and in this way prevent regurgitation of its contents through the puncta. Here then is a musculo-valvular arrangement very favourable to the flow downwards towards the nose.

Is the secretion suspended or only diminished during sleep ?—The surface of the eyeball being covered during sleep the primary stimulus to a flow of tears is necessarily absent, and the tears if secreted are probably retained in the oculo-palpebral folds till the waking moment, when the alternate movements of opening and closing the lids recommence and the passage of the tears goes on again in the usual way.

During a violent fit of laughter there is, owing to the spasmodic action of the walls of the thorax, a sudden rush of blood to the vessels of the head and the orbit. The whole of the orbital structures are charged with blood and the lachrymal gland with the rest. At the same time the orbicularis muscles are thrown into convulsive contraction, and the gland thus stimulated into activity from within by the sudden afflux of blood, is compressed not only by the increased volume of the orbital contents, but at the same time by the backward pressure of the plane of the contracted orbicularis. Hence the abundant secretion of tears. Their overflow is partly explained by the over-distension of the veins surrounding the sac in the osseous parts of its course, which veins, according to Robin and Cadiat, are numerous and large and give a cavernous character to the submucous tissue (*Journal de l'anatomie et de la physiologie*, 1875, p. 494). In this way the contents of the orbit are probably relieved of what would otherwise be a dangerous excess of pressure and one which would, if prolonged, act secondarily on the contents of the cranium. In yawning there is a slight overflow of tears due to similar causes.

position it may assume. The sac, however, being attached to the anterior band of the ligament follows its movement. Hence it would appear that when the inner canthus advances the anterior wall of the sac also advances and its internal capacity is slightly increased. Merkel contends that there is no subsequent compression of the sac by Horner's muscle. I think, however, that this conclusion will hardly be borne out by the anatomical relations of the parts, for Horner's muscle being attached to the posterior band would by contractions indirectly act upon the anterior band or the tendo-palpebrarum and must by drawing this band backwards necessarily exert pressure upon the anterior wall of the sac (*see* figs. 2 and 3 on plate).

"The *tensor tarsi* (Horner's muscle) draws backwards the inner canthus and compresses the lachrymal sac, after it has been dilated by the orbicularis palpebrarum in the act of winking."—(*Ellis's Demonstrations of Anatomy*, p. 50).

SECTION II.

Preliminary Remarks on the Relations of Diseases of the Lachrymal Passages to Primary Lesions in the Nasal Fossæ on the one hand and to those of the Conjunctiva on the other.

Until quite recently alterations of the ocular surfaces have been almost exclusively credited with the origination of disease affecting the lachrymal passages, and there is no doubt that in a considerable number of such cases conjunctivitis in its various forms does really constitute the starting point of the lachrymal disease, either by extension of acute inflammation through the puncta or by displacement of these minute orifices as the sequel of chronic inflammatory change. In another series, however, inflammatory swelling or chronic thickening in the sac, nasal duct, or nasal fossæ, is the primary source of mischief, either in the way of extension of inflammation upwards, or by causing obstruction and consequent accumulation of mucus in the sac. The tendency of the present day is to trace from the nasal fossæ and even from the pharynx a large number of lesions in the sac, and it is quite necessary to make a careful examination of the nasal fossæ and pharynx in all such cases. It is very common to find chronic changes, such as polypi or chronic hypertrophic rhinitis in these parts, when attention has been directed in the first instance to the nasal duct or sac. In a third and perhaps the most numerous class both the conjunctiva and the nasal fossæ, and perhaps the pharynx, are all simultaneously affected, a condition not at all uncommon in scrofulous children, and in young adults, especially in young anæmic women. The condition of granular ophthalmia in adults is often associated with a similar condition in the pharynx, and secondary changes in the lachrymal passages are not uncommonly associated with them. Treatment confined to the ocular ailment under such circumstances leads often to disappointment and failure.

SECTION III.

Diseases and Displacements of the Puncta Lachrymalia.

When the eye is open the puncta lie in close apposition to the ocular conjunctiva, and, therefore, are not visible, but in order to see them the lower lid must be drawn downwards and away from the eyeball. They are kept in contact with the conjunctiva by atmospheric pressure in the open eye, when the eyelids are closed their orifices are turned inwards and immersed in the fluid of the lacus. In view of the fact that the tears gravitate towards the lower oculo-palpebral sinus, the part performed by the lower punctum is much more important than that of its fellow in the upper lid. Any abnormality of the lower punctum affects the passage of the tears to a much greater degree than similar disturbance of the upper one, and it therefore follows that the consideration of affections of the lower punctum is predominant and its treatment more essential. For this reason in the following paragraphs the observations will be mainly directed to the description of the diseases of the lower punctum and their treatment.

Displacements of the puncta result from four causes.

a. Any traction of the eyelid downwards and forwards.

b. Pressure from behind.

c. Displacements of the eyeball backwards.

d. Entropium.

a. The puncta are more or less displaced upwards and forwards by retraction of the eyelid from chronic diseases of its margin, *e.g.*, eczema, tinea tarsi, blepharitis and the various forms of ectropium whether of pathological or traumatic origin. They are also similarly displaced but to a less extent by the relaxed state of the orbicularis in very aged and debilitated persons, in whom the eyelid having lost its contractility and having become elongated falls away from the eyeball. A constantly congested and œdematous condition of the conjunctiva and skin results and the tears collect in a sort of cup and overflow from time to time upon the cheek, giving rise as a

secondary result to irritation and even excoriation of the adjacent skin.

b. Any inflammatory conjunctivitis with general swelling forces the eyelids away from the eyeball, and with them the puncta. Polypoid outgrowths and tarsal cysts act in the same way.

c. Senile entropium is the most frequent cause of inversion of the eyelid and is due to the wasting of the fatty tissue of the orbit in aged persons. The eyelid becomes rotated inwards on its horizontal axis. The same thing sometimes results from purulent ophthalmia. The lower puncta are then directed downwards, or may even be turned forwards by a complete involution of the lid and their proper functions are interrupted partly by their abnormal position and partly by the extension of inflammatory swelling to their orifices. Entropium, due to cicatricial contraction of the ciliary margin of the eyelids, whether from chronic blepharitis or inverted and irregular eyelashes, or from contraction of the conjunctival surface of the lid due to cysts or ulcers or injuries, has a similar result to those described under *c*.

Besides the overflow of tears with its attendant discomforts which result from their inversion or eversion, the puncta may in the course of months or years, if not replaced, become atrophied or contracted by inflammatory effusion and may even be obliterated.

Treatment.—The displacements due to temporary causes of an inflammatory nature may often be restored to a normal condition by remedies applied to the primary mischief. The eczema or blepharitis may in acute cases be cured rapidly and the puncta may then regain their normal condition. The same may be predicated in the early stages of relaxed lower eyelid of aged persons, and in the senile entropium it is sometimes possible to restore their position by suitable remedies commenced early. These, however, are the exceptions. As a rule, the overflow once established the local œdema and swelling are aggravated by the irritation of the morbid secretions, and hence it is necessary in the majority of cases to restore the flow by surgical means as a preliminary to treatment of the primary affection. For this purpose the lower punctum should be laid open by a Bowman's or Weber's canaliculus knife (see figs. 4

and 5 on p. 25, *infra*) having first applied a 4 per cent. solution of cocaine. The extent to which the canaliculus should be laid open must depend mainly on the amount of deviation, but as a rule it should be opened to not less than half its total length. The incision is not often too long as the wound has a tendency to close rapidly and it must therefore be probed daily for 3 or 4 days in order to prevent the divided surfaces reuniting. In the end a slit-like orifice remains which on cicatrization being complete will be found to be much shorter than it appeared at the time of the operation.

Sometimes the beaked point of the Weber's knife is too bulky to enter the contracted punctum, and great advantage is then obtained by the use of the straight knife (fig. 4), which having its edge carried almost up to its extremity cuts its way in through the tiny orifice. The blunt end can then be turned towards the floor of the canaliculus and made to slide along it till it has reached about two-thirds of the distance between the punctum and the sac, and the canaliculus can then be slit by causing the edges to cut its way out. Whichever instrument is used the edge of the knife must be brought out in a direction backwards as well as upwards. If the wound is made forwards the resulting slit is much less effective for the purpose.

This little operation is very often the beginning of a complete cure of the primary displacement of the eyelid, and gives a great deal of relief. The cut edges must be kept from uniting by daily probing, and subsequent treatment by antiseptic and astringent lotions will always be necessary.

Obliteration of the puncta arises from contraction of the skin and conjunctiva consecutive to blepharitis, tinea tarsi, ulcers of any kind, wounds, burns, granular ophthalmia and congenital malformation. It also sometimes occurs in cases of excessive dryness of the conjunctiva, xerophthalmia, or obliteration of the ducts of the Meibomian follicles.

The upper and lower puncta are seldom obliterated simultaneously, generally the lower one only is closed.

Treatment.—If the lower punctum be the one affected it may be left untouched, and the upper punctum laid open as far as the sac, the outer wall of the sac being left in communication with the *lacus*, and kept open by frequent probing daily for a fortnight. If this fails to restore the flow of tears the lower

canaliculus may be sought by penetrating the region near the dimple marking the site of the obliterated punctum, by a pointed knife or a broad needle, and the canaliculus being found must then be slit open.

If, however, this method fails, a portion of the conjunctiva close to the inner canthus may be cut away by means of a pair of scissors, the wound being made obliquely in such a way that the normal channel may be cut across. The opening found must be enlarged and kept open in the manner above described for displaced puncta.

FIG. 3.—Watson's lachrymal bistoury.

An alternative plan is to lay open the upper canaliculus as far as the sac, and when this wound has cicatrized to pass a probe from it into the region of the lower canaliculus as a guide on the protruding point of which the channel may be opened in the lower lid.

If a fistula on the cheek is present the probe may be passed through it upwards and outwards to the canaliculus, the inner wall of which may then be divided on its protruding point.

When both canaliculi are obliterated an attempt may be made to establish communication by an opening through the outer wall of the sac. This is very difficult unless there also exists a fistula on the cheek, when a probe may be passed into the sac, made to impinge on its outer wall, and so serve as a guide for the knife.

When no such guide is available a puncture is made in the region of the sac from the mucous surface of the inner canthus, and the sac will be found by means of a probe passed into the punctured wound. This wound should then be enlarged by means of a curved blunt-pointed bistoury of the form delineated.

The same instrument should be passed into the sac downwards, and any obstructions in that direction divided. A conical probe should then be passed and as soon as the passage is freely opened a style with an angular upper extremity inserted and left in. The angular upper extremity of the style is then bent over the lower lid, and allowed to lie on the skin of the cheek opposite the inner canthus. The style should be left in position for three, four or five weeks, and if necessary, should be replaced by a larger one when removed. Operations of this kind are required only in exceptional cases, and as a rule when the obliteration of the canaliculi has been caused by severe injuries complicated by displacements or fractures of the adjacent bones.

SECTION IV.

Obstruction and Obliteration of the Canaliculi.

The causes that give rise to obstruction are four :—(1) alteration of their direction by **distortion of the eyelids** from any cause; (2) **inflammation of their mucous lining;** (3) **cicatrices of traumatic origin;** (4) **the lodgment of foreign bodies within them.**

(1) The effect of **distortion of the eyelids** is to prevent the tears reaching the puncta, and if the distortion is great and a bend is formed in the course of the canaliculi they become narrowed and their mucous lining becomes adherent by its opposite sides.

(2) **Extension of inflammation from the conjunctival surface,** whether in purulent ophthalmia, granular ophthalmia, or any acute conjunctivitis, will often obliterate or obstruct the channel which ultimately becomes a mere solid cord.

It is also asserted that trachomatous inflammation originates in the canaliculi, though they do not normally contain lymphoid tissue. This disease appears in the form of epithelial alterations, and even of glandular crypts (M. Cirincione (Naples), *Annales d'Oculistique*, Nov., 1891).

(3) **Cicatrization following granular ophthalmia,** wounds, or burns, destroys the continuity of these channels.

(4) Sometimes a **detached eyelash** passes into the punctum, and thence into the canaliculus, the upper one being most frequently the seat of this accident. The result is great irritation, both of the channel itself, and of the conjunctiva, which is continually fretted by the free extremity of the hair in the punctum. **Other foreign bodies** such as fragments of chaff, feathers or hair, are occasionally seen in a canaliculus, setting up inflammatory action within it.

The presence of **calculous deposits** is also an occasional cause of obstruction and of muco-purulent discharge. The hard prominence of the swelling without any undue fulness of the region of the sac supplies the diagnosis from mucocele, but an

incision and removal of the concretion are necessary to confirm it. I have seen several such cases. The results of a simple incision and extraction are very satisfactory.

The concretions consist of phosphates and carbonates of lime and magnesia, and in a few cases intermingled with them are found confervoid growths of a greenish colour. A case of this kind is recorded by Dr. Bristowe in the *Pathological Transactions*, vol. xxiii., p. 293. A substance removed from the lower canaliculus resembled in shape, size and colour, a green pea. It appeared in the lower eyelid as a red inflammatory swelling projecting on both aspects, and forming a most unsightly prominence. It consisted "first of immense numbers of long vegetable organisms; and secondly of large numbers of small roundish or angular bodies which seem to be chiefly dead and disrupted nuclei of cells. The vegetable organisms are, I think, chiefly dead and motionless bacteria and fine confervoid filaments."

A similar case has been recently under my care, the deposit resembling, both in consistence and colour, a partially boiled green pea, but being of the size of a rape seed.

Abscess with dilatation of the canaliculi must be of very rare occurrence except in connection with the formation of concretions or the presence of foreign bodies of any kind. I have never seen an abscess of either of the canaliculi, nor a fistula of these channels.

SECTION V.

Congenital Anomalies of the Puncta and Canaliculi.

These abnomalities are unimportant from a clinical point of view, and very rare. They are only seen in connection with other congenital defects of the eyeball, lachrymal gland and eyelids, in cases for instance of anophthalmus and microphthalmus. In a few rare cases, congenital absence of one punctum, generally the lower, has been recorded. The treatment is the same as for obliteration from inflammation or traumatism.

SECTION VI.

On Obstructions of the Lachrymal Sac and Nasal Duct.

If we glance at the anatomical relations of the series of channels constituting the excreting lachrymal apparatus, we observe that there are three, or perhaps four principal spots at which obstructions are likely to occur, viz.:—(1) **the point of entrance of the common duct of the canaliculi into the sac**; (2) **the point at which the lachrymal sac enters the nasal duct**; (3) **the valvular termination of the nasal duct in the inferior meatus of the nose,** and (4) **perhaps at a partial fold or dissepiment about the middle of the nasal duct.**

The most common obstructions are due to alterations in the mucous membrane; and thickening of this membrane from congestion or inflammation, is the most frequent kind of alteration. Next in frequency, come obstructions due to ulceration and contraction of cicatrized ulcers, and next to these, alterations of the bony walls, such as periosteal thickening or swelling from any inflammatory cause. For convenience, we will divide all causes of obstruction into two classes; (1) those that are *temporary* in their nature, and require no mechanical dilatation in order to remove them, and (2) those of a *permanent* kind, in which mechanical dilatation is absolutely essential. The first class, I believe, includes a much larger number of cases than was at one time thought, and I have learnt by experience that many cases of epiphora, even when associated with mucous regurgitation through the puncta, will get well, either spontaneously or with the aid of constitutional remedies and local counter-irritation of the skin of the region of the sac. The catarrhal or other swelling of the mucosa passes off in this region, as it does in the Schneiderian membrane, and in the conjunctiva, and leaves the channels free from obstruction, as soon as the general health is restored. But it cannot be denied, that what was at first a *temporary* obstruction, may pass into the

permanent condition if neglected. If, for example, the flow of tears and mucus is stopped for a considerable time, and these secretions accumulate, so as to distend the lachrymal sac, the effect is to set up acute inflammation in those parts at which the pressure is most felt, and ulceration and a glueing together of the opposed surfaces may take place at the narrowest parts of the channel, and a membranous, fibrous, or even a bony obstruction may be thus induced. So that, in any case in which there is a doubt as to the nature of the obstruction, it is better to assume it to be of a permanent character, and to employ mechanical dilatation *tentatively*, than to lose time by the use of ineffectual remedies.

Diagnosis of Temporary as opposed to Permanent Obstructions.—We judge that an overflow of tears is due to *transient* causes if it has come on in the course of catarrh, or has immediately succeeded an attack of any form of rhinorrhœa, and if the discharge from the puncta, on making pressure over the region of the sac, is small in quantity and nearly transparent, consisting, in fact, of but slightly turbid mucus, and if these symptoms have only recently shown themselves in a patient with some constitutional weakness, especially in very old or very young persons. It is more certainly ascertained that there is no permanent obstruction, if saline injections through the puncta have been made use of, and the solution has found its way into the nose and pharynx. Under these circumstances, we may generally succeed in relieving the patient without any operative interference, by constitutional treatment only, or with the aid of local counter-irritation. Iodine paint applied over a very limited space between the inner canthus and the bridge of the nose, is very useful in these cases, and when there is reason to suppose that the obstruction is due to swelling of the lower end of the nasal duct, the inhalation of a mixture of carbolic acid, ammonia and spirits of wine, or the use of the scented snuffs, will generally overcome the obstruction and relieve the patient.

SECTION VII.

Chronic Dacryocystitis, *Syn.* Mucocele, Blenorrhœa Lachrymalis, Catarrh of the Sac.

Chronic dacryocystitis, or *mucocele*, most commonly results from the extension of catarrhal inflammation or scrofulous catarrh from the conjunctival surface. There is often a similar affection of the nasal mucous membrane associated with that of the eyelids, and in either case the canal of the lachrymal sac, or its continuation into the nose, is liable to become engorged and choked with mucus. The consequence of this is, that the flow through it is obstructed, mucus collects and distends its cavity, the tears flow over the eyelid on to the cheek, there is regurgitation of mucus from the puncta lachrymalia when pressure is made on the sac, the skin over it becomes red and sometimes inflames and ulcerates, and the nasal fossa of the corresponding side becomes dryer than before.

Mucocele seems, in some cases, to arise from obstruction to the flow of tears through the canaliculi. If the puncta lachrymalia happen to be everted, or thrust away from the eyeball from any cause, as, for instance, by chronic thickening of the eyelid, there is an overflow of tears, and the lachrymal sac becomes choked with mucus and congested from an insufficient supply of moisture passing through it. The chronic thickening of the eyelids may be an indication of a similar chronic thickening of the lining membrane of the sac, each being the result of a precedent attack of catarrhal inflammation, or of a chronic conjunctivitis with nasal complications, such as are often seen in the case of scrofulous children.

The superficial appearance of swelling at the inner side of the eye is at first often quite insignificant, and indeed not noticeable until pressure being made on it by the finger, mucus, or pus regurgitates through the puncta or passes downwards into the nose; but if the disease has continued for any considerable time, the swelling of the sac becomes very conspicuous, pressure

no longer disperses it, and in a case that has gone on uncontrolled or neglected for years it may result in a prominence at the sulcus, between the inner canthus and the nose, of the size of a filbert, or even larger. This swelling is generally marked over its centre by a horizontal or depressed line or furrow, showing the position of the tendo-oculi and its relation to the distended sac.

In those chronic mucoceles in which pressure fails to produce regurgitation of fluid of any kind through the puncta, or escape of the contained fluid downwards, there must be not only occlusion of the canaliculi (probably close to their point of entrance into the sac), but also occlusion of the nasal duct. When these encysted mucoceles are opened, the contents are found to be yellowish glairy translucent fluid of the consistence of white of egg, and they sometimes contain cholesterine (see Critchett's Lectures in the *Lancet* of 1864, vol. i., p. 86). I have seen several such cases, but since the treatment of the early stages of mucocele has become better understood they are much more rare.

The **diagnosis** of cases of mucocele is generally not difficult; tumours or cysts in the immediate neighbourhood of the sac sometimes bear a superficial resemblance to mucocele, but they are rarely so situated as to cause obstruction to the flow of tears, and hence, stillicidium lachrymarum, the most characteristic symptom of mucocele, is almost always wanting in the case of tumours. Sometimes, though the obstruction in the lower part of the sac or the nasal duct may be sufficient to prevent the flow of mucus through them into the nose, yet, when pressure is made over the swelling, it disappears, without any appearance of mucus from the puncta, and the patient experiences a sensation of fluid having passed into the nose. The obstruction has, in fact, been overcome by the pressure employed, though the ordinary flow has been insufficient to effect its passage through the congested and swollen membrane. Patients frequently find this out for themselves, and, by employing pressure with the finger over the region of the sac, empty it into the nose as often as they find its bulk increasing. By doing this at rather frequent intervals during the day, they are able to avoid, to a great extent, the inconvenience resulting from a constant overflow of tears.

Treatment.—Topical medication of the sac by the use of lotions, boric acid, zinc and peroxide of hydrogen, either by instillation or the use of Anel's syringe, and the improvement of the general health by general medication and change of air will often bring about an improvement in the quality of the secretion, and a cessation of overflow of tears. If, however, after a month or six weeks, no improvement takes place, mechanical measures will become necessary, and the lower canaliculus should be laid open by means of the Weber's or

FIG. 4.—Bowman's canaliculus knife.

Bowman's knife. This little operation, first devised and systematised by Sir W. Bowman, leaves a freer aperture, and lotions can then be applied more directly to the lining membrane of the sac, and the subsequent progress of the case will

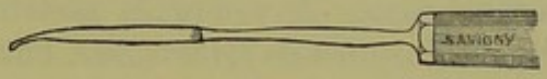

FIG. 5.

as a rule be very satisfactory, provided the general health can be carefully attended to. Where there is an obstinate scrofulous diathesis, and in some cases of gouty dyscrasia, the course of the local disease resists treatment for months, and in severe secondary syphilitic cases the nasal complications will require separate treatment for the cure of ulcerations or removal of necrosed bone from the nasal passages.

Whenever there is reason to suspect tertiary syphilis, the treatment by probing of the duct or sac should be carefully avoided, until the constitutional malady has been cured by specific remedies. In one such case in which probing was used before the constitutional dyscrasia had been overcome, extensive necrosis of a portion of the upper jaw supervened, and a sequestrum had to be removed through the mouth.

In the following case, which may be regarded as a typical one, the local treatment was preceded and accompanied by a systematic course of general specifics and with the best results.

Mr. C., forty-five years of age, came to me with watering of the right eye, associated with a feeling of obstruction in the right nostril. He had at the time a pallid, anæmic aspect, and a languid and feeble gait; his gums were sore and inclined to bleed. Four years before, he had suffered from an attack of inflammation of the eyes in the course of secondary syphilis, the primary symptoms having occurred two months before. About nine weeks before presenting himself, he noticed the watering of his right eye, and the escape of a yellowish-red discharge from the right nostril, which he felt to be obstructed. He had also at times a severe pain (described by him as neuralgic), which affected the head as from an ordinary cold. Traces of iritis were visible in both eyes. On passing a nasal speculum, an ulcer of the septum was seen running obliquely downwards and forwards, the adjacent parts of the mucous membrane being thickened, so that the edges of the ulcer were somewhat steep and abrupt. The surface of this sore was covered with a dirty grey lymph-like serum, which seemed inclined to dry into a scab. A yellowish matter exuded from the nostril, and had *a somewhat fœtid odour*, but not such as is generally associated with dead or carious bone.

Under a course of mercury and nasal douches his general health improved, the obstruction in the nostril diminished, the ulcer became more healthy-looking, and the discharge less copious and less offensive; but, notwithstanding these signs of general amelioration, the lachrymal sac became much swollen about March 4th, and the increased fulness and hardness in this region prevented its being emptied by pressure. Up to this time the patient had always been able to press the accumulated mucus downwards into the nose, and so to cause the disappearance of the swelling.

I now laid open the lower canaliculus of the right eye, and passed a probe, but not into the sac itself.

On March 5th I succeeded in passing a probe into the sac, and on the 8th quite into the nasal duct.

From this date the progress continued slowly but steadily. The ulcers in the nostril gradually healed, and on June 10th he had discontinued the mercury for some weeks, having commenced the syrup of the iodide of iron. At this time there was little or no discharge, and no overflow of tears from the

lachrymal sac. Probes had been passed from time to time, until a full-sized Watson's probe was passed easily. The douche was still used night and morning, and although there was occasional fetor, it had very much diminished.

October, 1877.—During the latter part of 1876 he continued to have probes passed occasionally, and up to this date they had been used about once in six or eight weeks. He has no epiphora, and wishes the probe to be passed rather as a precaution, and to prevent the possibility of a return of the stricture. He continued the iodide of iron for some months, and then resorted to cod-liver oil. His health became rapidly re-established, and is now excellent.

A somewhat similar case to the above was under my care at the Central London Ophthalmic Hospital. In this case both nostrils were affected, and the septum had become perforated by ulceration before the commencement of treatment. Under a course of iodide of potassium with mild mercurials the condition of the nostrils rapidly improved, and the treatment by mechanical dilatation of the nasal ducts (both of which in this case were affected) was proceeded with. The patient was perfectly relieved, though before the use of remedial measures the obstruction in the lachrymal passages had led to large abscesses and fistulæ in both lachrymal sacs.

From these and other similar cases I am inclined to think that the constitutional treatment of lachrymal obstructions is quite as important as the mechanical measures, and that the condition of the whole tract of mucous membrane from the conjunctiva to the nostrils is at fault in the worst forms of mucocele; that the obstruction, in fact, depends rather upon a uniform narrowing of the whole extent of the series of channels, than upon a stricture limited to one or two points. Nevertheless, there can be no doubt that in the later stages there are certain points in the lachrymal sac which are more likely to become permanently closed, and hence we often find a tight stricture either at the opening of the canaliculi into the sac, or at about the lower third of the sac itself.

In cases in which the constriction of the duct is rigid or too tight to allow of the emptying of the sac by pressure, it is necessary to overcome it by the following series of small operations. First, the canaliculus of the lower eyelid

is laid open, the conjunctiva being under the influence of free local application of cocaine (4 per cent. solution), and antiseptic solutions having been freely applied. Either the 1 in 5000 solution of perchloride of mercury, or the saturated solution of boric acid, will be suitable for this purpose. (For the instruments to be used, *see* figs. 4 and 5, *supra*). This done, a probe should be passed along the canaliculus and into the lachrymal sac, and then turned into a vertical position and passed down to the obstruction in a direction downwards, backwards, and a little outwards. The constriction will yield, and the probe passes down into the nose. If it has taken the right course, and is lying in the lachrymal sac and nasal duct, its free extremity will be resting against the upper margin of the orbit, and its course will be described by a line which, passing through the centre of the tendo-palpebrarum, cuts through the inner extremity of the eyebrow above, and the interval between the second incisor and canine teeth below. This line corresponds very nearly with the superficial furrow between the ala of the nose and the cheek. The upper end of the probe will also be inclined obliquely forwards and inwards. If it lie much outwards, it must have passed through the os unguis into the nose; if it lie too obliquely forwards and inwards, it may have passed into the antrum. Any marked deviation from the position above indicated will imply a faulty direction of that part of the probe which is not visible. The passing of the probe requires some skill and delicacy of manipulation, but it is rare that any mischief results from it, although rough handling or imperfect knowledge of the anatomy of the parts may lead to disastrous results here as elsewhere.

Having overcome the obstruction, it is well to leave the probe in the stricture for a few minutes, in order to subject it to some amount of pressure, and so to favour subsequent absorption. I prefer the probes of the form figured (*see* figs. 6 and 7). They are made somewhat thinner towards the point than above, and terminate by a bulbous extremity. Sir W. Bowman's probes are made in four or five different sizes, to suit the varying amounts of constriction met with, and are formed into a spiral, so that by slightly rotating one on its axis the point may be made to describe a circle, when within the sac, and thus have a better chance of coming upon the aperture, or that part

at which least resistance is offered. For certain cases of very tight stricture it is well to be provided with a set of these fine probes, but the smaller the probe the greater the risk of running its point between the mucous membrane and the bone, and so making a false passage; whereas with the bulbous-pointed probe it is impossible to do this without employing much greater violence than any prudent surgeon would be likely to attempt.

For very tight strictures a very fine steel bulbous probe, nickel-plated, is very useful. It may be made almost as fine as a hair, and yet be tempered so perfectly that there is no risk of its breaking. Messrs. Wright, of Bond Street, have made these probes for me. I am well satisfied with them, and find them very useful in practice.

After removing the probe, a few drops of blood will flow from the nostril. The probe will have to be passed at intervals of two or three days, until all signs of stricture have disappeared, antiseptic solutions being frequently applied. Probably after the first few times of passing it, the mucus that regurgitates on

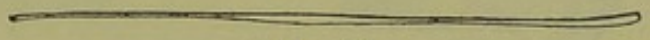

Fig. 6.

Fig. 7.

pressure over the region of the sac will be mixed with blood; then, in a few days, it may become purulent or muco-purulent, and if this be associated with swelling, heat, redness, and tenderness of the parts adjacent, it will be advisable to discontinue the use of the probe for a week, as there is probably too much inflammatory action going on in the part, and any increased irritation would lead to mischief. If, however, the purulent discharge is only slight, and unaccompanied by inflammatory redness, the probe may still be used at intervals, and in the course of a few days the regurgitation on pressure will be simply serous or will not occur at all. In the meanwhile the overflow of tears has been steadily becoming less and less troublesome, and at length disappears altogether.

Whenever the progress is slow, and in all cases when the general health seems in any way at fault, constitutional treatment will be required in addition to the local manipulations.

In young people scrofula is often associated with mucocele, and cod-liver oil and iron are often necessary. In elderly people a gouty diathesis is sometimes found with this affection, and regulation of the diet and medicines directed against faulty assimilation and secretions will be required. In ill-fed people, such as we see at hospitals frequently, improved diet often seems to be the most essential means of improving the patient's general health and tending to remove his local ailment.

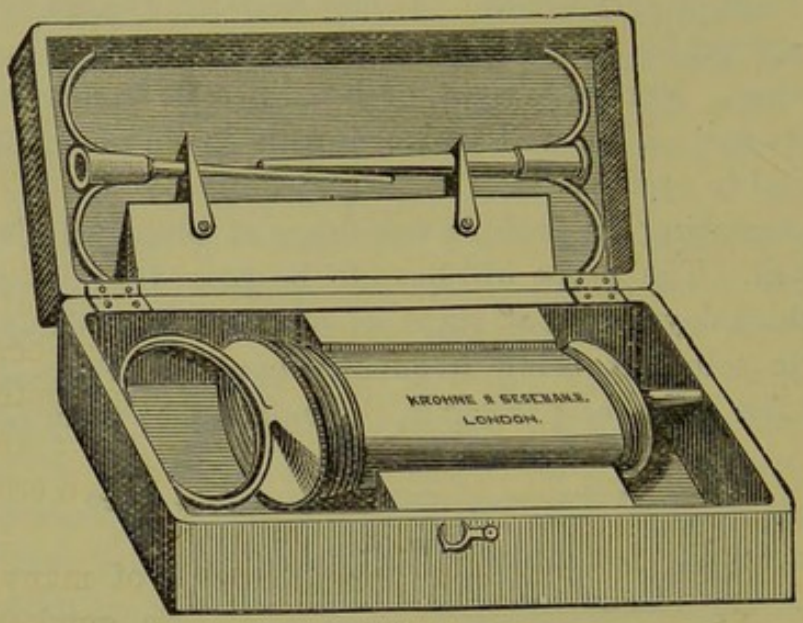

FIG. 8.

If we find that, even after the obstruction has been overcome and the general health improved, there is still a discharge of mucus or pus, and still an overflow of tears, it is probable that the sac has become altered in character and its secreting function has become so vitiated by long-continued inactivity that it requires some stimulating application. To effect this a syringe,*

* The syringe should have two or three fine nozzles of different sizes, curved so that they can be passed easily into the sac, and the nozzles should be attached to the body of the syringe by means of an india-rubber tube, which is freely movable, being capable of detachment and re-attachment by a simple joint without a screw.

This flexible piece of india-rubber enables the operator to work the piston of the syringe at an angle to the part in the sac, and without causing any jar or wrench to that part lying in the sac. A syringe for this purpose, with a plated metallic barrel instead of glass, as they are ordinarily made, is sold by Messrs. Krohne and Sesemann, and is admirably adapted for the purposes for which it is designed. (*See* fig. 8). A metal syringe can be rendered completely aseptic by immersion in boiling water, an advantage which glass syringes do not possess.

somewhat like that known as Anel's (but having certain special modifications in its structure) may be employed to inject solutions of metallic salts into it from time to time.

A solution of sulphate of zinc (gr. 4 to fl ʒ j.) or of chloride of zinc (gr. ss. to fl ʒ j.) will often improve the character of the secretion of the mucous membrane, if injected every other day or every third day, by means of the syringe above described, or by any other suitable apparatus.

If all these means fail to stop the overflow of tears and the mucous regurgitation on pressure, we next proceed to pass a style and to keep it in the duct for some weeks until the passage has become thoroughly dilated. The soft virgin silver is the most suitable material for a style, and it should be made with a narrower portion at its upper end, which can be turned over the edge of the eyelid and so retained in position.* For hospital use the pure leaden style used by Mr. Green, of Philadelphia, and which I have myself very frequently employed, answers extremely well. It is a good plan to use a rather thin style at first, and in a week to replace it by a larger one, until at the end of three or four weeks one of the size of a crow-quill may be introduced.

In very obstinate cases, or in neglected cases of many years' duration, the larger the diameter of the style employed the better the chance of a permanent cure. The sac is sometimes so much distended and thickened by chronic mucocele that its walls lose their elasticity, and hence, when the natural channel is restored, the sac still remains as a prominent and unsightly tumour at the upper part of the cheek. To overcome this, it is a very good plan to lay open the sac and dissect out a portion of its anterior wall, cauterising the interior with solid nitrate of silver, and then to bring the edges of the skin together by sutures. There is some risk of leaving a fistula, but this will not generally happen, if the obstruction

* The virgin silver was first employed as a material for styles by Mr. E. C. Hulme, and are described by him in an article in the *Medical Times and Gazette* of May 21st, 1859. Some further valuable observations of Mr. Hulme's on the subject will be found in a letter in the *Brit. Med. Journal* of April 11th, 1863. He still considers these virgin silver styles to be very useful "in appropriate cases, especially in hospital practice, where time is of such importance to both patient and surgeon. "I never saw," says Mr. Hulme, "any bad result, nor even any objection on the part of the patient to their use."

in the lower part of the sac has been previously overcome by appropriate treatment. Another plan is to pass a seton through the prominent parts of the sac and leave it in until free suppuration is established, after which contraction will be almost sure to take place and the seton can then be removed. The cases, however, that require this plan of treatment are very rare.

In very obstinate cases some surgeons have employed the actual cautery for the purpose of obliterating the sac, but this is a method of treatment which seems both illogical and unnecessarily severe. It is much better to lay open the sac freely and apply solid nitrate of silver, Vienna paste,* or the electric cautery, to the exposed mucous membrane, leaving it open until free suppuration is established and healthy granulations have sprung up. Meanwhile, as soon as the acute swelling consequent on the application of the caustic has subsided, probes should be passed daily through the previously-opened canaliculus, and the stricture dilated by progressively increasing the size of the probes employed. The object of this treatment is not, of course, to obliterate the sac, but to cause a more healthy secretion of its lining membrane, to destroy the thickening of the submucous tissues, and to reduce the calibre of the sac by the shrinking consequent on cicatrization.

It is a question in some cases of obstinate dacryocystitis of long-standing, whether the subcutaneous abscess which has formed during its progress may not be the cause of the difficulty of healing. A **pericystitis** has been going on, and the granulations outside the sac remain as a hindrance to the healing of the fistulous opening. These granulations must be dealt with by scraping with a curette and the subsequent application of chloride of zinc or some similar stimulant. The most recent researches of Parinaud and Widmarck have demonstrated that in pericystitis the pus which undermines the margins of the abscess or fistulous opening contains various micro-organisms, notably the *staphylococcus albus*, the *staphylococcus aureus*, and the *streptococcus pyogenes*. These microscopic organisms have also been found within the sac during the course of chronic dacryocystitis, and their presence in the subcutaneous tissues seems to indicate that the pericystitis is due to migration from

* The Vienna paste should be applied through a glass tube with a minute orifice, which may then with due care be thrust into the open sac.

the sac into the surrounding tissues. Hence the importance of establishing at as early a period as possible a free passage through the nasal duct, and the advantage to be derived by the free irrigation of the passages by antiseptic solutions. The solution of perchloride of mercury (1 in 5000) should be applied and injected by the Anel's syringe during the whole course of the treatment (see Parinaud's paper in the *Annales d'Oculistique*, Mai-Juin, 1891).

Some cases of mucocele are found to depend upon the persistence of very tight strictures, which resist the passage of probes altogether, or admit only very small probes, and with great pain and distress to the patient. The stricture is, in these cases, due to cartilaginous thickening of the submucous

Fig. 9.—Stilling's knife.

or periosteal tissues at the lower end of the sac, or in the nasal duct, or possibly may depend upon chronic thickening of the bony walls of the canal. Under these circumstances I have found the division of the stricture by means of Stilling's knife (fig. 9) has been a most successful operation. In order to perform it, the patient, unless of very heroic temperament. should be put under the influence of an anæsthetic. The canaliculus having been previously laid open, a probe is passed into the sac, in order to enable the surgeon to ascertain the seat and nature of the stricture. Stilling's knife being then passed at first hori-

Fig. 10.

zontally, its point is turned downwards, and its cutting edge held forwards, and it is then carried vertically downwards until it meets with the stricture. This is divided by turning the cutting edge against it in three or four different directions; next a full-sized conical probe (fig. 10) is passed, with the intention of freely separating the newly divided edges; and lastly, a silver style introduced, and left in for a week or ten days, or until the discharge assumes a simply serous character. After the removal of the style it will be necessary to pass a probe about once or twice a week for several months, as there is a great tendency to

the return of such strictures if neglected. It is important, in the treatment of such cases, to ascertain that the obstruction to the flow of tears into the nose is not due to acute periostitis, nor to the presence of necrosed bone. These conditions are indicated by inflammatory redness, pain, and exquisite tenderness over the bones and cartilages of the nose; and of course the operation just described would be entirely unsuitable, or even mischievous, when such a set of symptoms were present. Various instruments have been devised for division of strictures of the nasal duct, among others the guarded cannula-lancet (Bowman's) may be occasionally useful; but, in the majority of cases, the operation can be better performed with the aid of Stilling's knife than with that of any other cutting instrument. (*See* fig. 9).

In those extremely rare cases in which the obstruction is due to **exostosis in the nostril,** or to **chronic thickening** of the **bony walls of the nasal duct,** consequent on disease or injury, it is possibly the best way to establish a passage directly into the nostrils by perforating the os unguis, and keeping the aperture open by daily probing for a week or ten days. Constitutional treatment will, in some cases, be required, but in the majority the removal of the obstruction is sufficient to effect a cure. If the operation of perforating the outer wall of the sac be resorted to, certain anatomical considerations must be borne in mind in order to render it effectual. If the upper part of the outer wall is perforated, the aperture leads to the anterior ethmoidal cells, but the lower extremity of the sac lies at the level of the middle meatus of the nose. This, therefore, is the point at which the perforation of the sac must be made in order to get a free flow of tears into the nasal fossæ. That the disease is constitutional is not necessarily proved by the fact of its affecting both lachrymal sacs. This symmetrical form of dacryocystitis is not at all uncommon, but it more often depends upon a previously symmetrical blepharitis than upon constitutional defects; sometimes, however, both causes operate together.

For the **treatment of thin walled mucocele** without any marked regurgitation, the late Mr. George Critchett devised a form of **truss** fastened round the patient's forehead, and with a padded spring to exert continuous pressure upon the dis-

tended sac. The cases in which this treatment could be employed must be very uncommon, but the method would be worth trying when from any cause probing was declined and other methods above described could not be effectually carried out.

In the inveterate cases of persistent lachrymation after the excretory passages have been rendered pervious, it has been laid down by some ophthalmic surgeons that relief can be obtained by the **obliteration of the lachrymal gland** or **of its palpebral accessory part.** This operation should only be employed as a *dernier ressort* when all other means have failed to relieve the obstinate lachrymation. According to De Wecker and Panas (*Annales d'Oculistique*, Mai-Juin, 1891, pp. 232 and 234) the removal of the palpebral accessory portion of the lachrymal gland, through the upper conjunctival sulcus, is a justifiable operation in such cases only as have resisted treatment by all other recognised methods. The excretory ducts of the orbitar portion of the gland pass through the accessory palpebral portion, and the result of the removal of the latter is to cut off the secretion from the former, and leads to its ultimate atrophy. As a matter of fact, this operation is rarely resorted to.

SECTION VIII.

Acute dacryocystitis, or abscess of the lachrymal sac, may arise from a variety of conditions. Perhaps the most common cause is the supervention of acute inflammation on chronic mucocele. The continued irritation caused by the mucus accumulating in the sac gives rise to puriform discharge containing micro-organisms, the lining membrane becomes inflamed, and the tissues around it become involved in the same unhealthy action. In scrofulous children, as a consequence of the extension of catarrhal inflammation from the adjacent mucous membrane of the nostrils, or from the conjunctiva (sometimes both being involved in the same action at the same time), there is sudden swelling and inflammation in the sac and its integumentary covering, with acute pain and overflow of tears on the cheek. The skin soon becomes red, sometimes both eyelids and the adjacent parts of the cheek are swollen, and after a few days, or at the end of a week, there is evident pointing of matter near the inner canthus, generally a little below the tendo oculi, and at this stage fluctuation is felt distinctly over the most prominent part of the swelling. If the abscess is allowed to go on uninterrupted, the reddened integument becomes thinner and thinner at this point, and ultimately bursts, giving exit to a purulent discharge; or, in rare cases, though there has been no pointing of matter on the cheek, the swelling of the eyelids and in the region of the sac may suddenly disappear, after the discharge of pus and blood from one nostril, the patient experiencing immediate relief. When this happens, we must suppose that the abscess has found its way into the nose through a very thin os unguis, or through one that has become softened and perforated by pressure. The pain, swelling, and redness then subside, but a discharge continues from the ulcerated aperture, and unless further treatment is adopted, a fistulous opening remains permanent, and the overflow of tears continues. In adults especially, if the general health is bad and broken down by debilitating causes of any kind, acute abscess may come on in

the course of any catarrhal attack affecting the mucous membranes of this region.

These abscesses frequently follow febrile disorders, such as measles, scarlatina, and typhoid fever, and in aged persons may be the result of gouty catarrh of the conjunctiva. Among the less frequent exciting causes of abscess, syphilis affecting the bones of the nose, and causing caries or necrosis, is occasionally observed.

There is then acute pain and tenderness over the affected parts, and on opening the abscess, the probe comes in contact with bare bone, which is sooner or later removed or discharged from the opening in the form of a sequestrum.

The following is a good illustration of this :—A woman, about 35 years of age, married, and with two living children, presented herself at the Great Northern Hospital with a threatening of lachrymal abscess of the right side. On examining the region of the sac there was redness and swelling, and excessive tenderness of the bones around. The abscess was opened on the cheek, and temporary relief obtained. No probing of the sac or duct was attempted. It appeared from her history that she had been the subject of primary syphilis soon after her marriage ten years before, and that she had since suffered from secondary and tertiary forms of the disease. The soft palate was eroded by old and recent ulcers, and the nose had recently been discharging, the discharge being very offensive.

Douches of water, with Condy's fluid, were used freely to the nostrils, and the iodide of potassium given internally, the ulcerated surfaces within the nostrils being occasionally touched with caustic. The disease however progressed, and several small pieces of bone escaped, one of them evidently from the region of the inflamed sac. The ulcer on the cheek then healed, and the overflow of tears ceased, and after a course of arsenic, iron, and cod liver oil, the ulcers within the nostrils also healed, but not before the septal cartilage had been entirely destroyed. The woman's health rapidly improved under the treatment by arsenic and iron, there had been no return of ozæna, nor of overflow of tears, for several months when last seen.

Chronic periostitis may give rise to abscess by obstructing the nasal duct and causing accumulation of mucus, and subsequently purulent inflammation.

Polypi and other tumours within the nostrils may cause similar obstruction and subsequent inflammation; and lastly, injuries of the bones of the nose bring about the same series of morbid processes, sometimes with the complication of necrosis of the parts injured.

In one case that came under my care some years ago, the exciting cause of the abscess seemed to be inoculation with the poison of glanders, accidentally spurted into the patient's eye.

A. F., a horse slaughterer, aged 34 years, came from a town in Wales to the Ophthalmic Hospital, with a ragged, indolent ulcer on the cheek over the region of the left lachrymal sac. It was attributed by him to inoculation with discharge from a glandered horse fourteen weeks before admission; he had no other sores about him. The ulcer presented flabby serous granulations, and its outer margin was excavated, as if spreading in that direction. When pressure was made over the sac, a puriform discharge escaped on the ulcer.

The lower canaliculus was divided by Bowman's knife, and after some difficulty a small probe was passed through a very tight stricture in the sac.

Nitric oxide of mercury ointment was applied to the sore, and probes passed every other day, their sizes being gradually increased until a full-sized probe could be easily introduced. At the end of a month, the sore had so far healed that the patient returned home to Wales. On May 9th (three months after the commencement of treatment) he writes word that "the ulcer on the face is nicely healed, except a very small sinus, through which sometimes oozes a tear." He had ulcers of the throat, but of what nature he was unable to explain. His general health had much improved.

Any animal poison, such as that of gonorrhœa or syphilitic discharges, may similarly excite the lining membrane of the lachrymal sac to suppurative inflammation.

Diagnosis.—In a case in which there has been stillicidium and other symptoms of obstruction in the sac for any lengthened period, before the outbreak of the acute swelling in the region of the sac, it is not difficult to seize at once on the true nature of the complaint. The swelling in any case is situated, in the first instance, between the root of the nose and the inner canthus, and in this region the finger will detect at this stage a round

induration which is extremely tender, and which the patient instinctively endeavours to protect, shrinking away suddenly the moment it is touched by the surgeon. But in the majority of cases the patient does not present himself until the swelling has extended considerably beyond the limited area above mentioned, and both eyelids and the upper part of the cheek are often involved in one uniform swelling; so that at first sight it is quite possible to regard the case as one of erysipelas of the face, or of inflammation or abscess of the eyelids or the orbitar cellular tissue. An alveolar abscess of the incisive or canine fossa sometimes gives rise to a somewhat similar swelling of the cheek and lower eyelid, and hence mere ocular inspection will seldom suffice for the purpose of diagnosis. A careful and delicate exploration of the region of the sac with the finger will, if it be a case of abscess of the sac, invariably detect the round or oval induration, marked superficially by a horizontal band due to the stretched tendo oculi (not, however, always distinguishable), which is characteristic of the special case in question. Abscess or tumour starting from the frontal sinus, or the orbitar cellular tissue, will be felt higher up and more above the line of the tendo oculi, that of abscess of the sac lies principally below this tendon and sometimes entirely below it. Abscess in the alveolar border will present the tender and swollen prominence in the region of the canine or incisive fossa, and will be detected when examined within the mouth.

Erysipelas will be distinguished from all these cases by the uniformly tense and shining character of the integumental swelling, by the excessive general febrile disturbance, and by the absence of any one tender and indurated spot or area of tumefaction in the subcutaneous tissues. In the more advanced stages of abscess of the sac, the swelling of the eyelids and upper part of the cheek subsides, and there is then a circumscribed swelling, visible to the eye and easily defined by the finger, lying between the root of the nose and the inner canthus, but most prominent at the inner extremity of the lower eyelid. In this area fluctuation soon becomes perceptible, and if the knife is withheld the skin becomes discoloured, attenuated, and at last gives way with the escape of pus. In two cases in my own practice, one occurring in a young child and the other in a woman of forty, the abscess burst through the os unguis into the

nose, and should this occur the diagnosis would be more difficult and uncertain. Abscesses superficial to the sac and boils in this region are sometimes mistaken for the more deep-seated purulent collection; but in these cases there is an absence of the overflow of tears which is invariably present in the case of true abscess of the sac, and the swelling is from the first more superficial and more strictly confined to the skin and subcutaneous areolar tissue in the case of boils or cutaneous abscesses.

The presence of tumours or polypi in the nostrils, as an exciting cause of the mischief in the sac, will be easily detected by an examination of the nostrils. Syphilitic periostitis of the bones and necrosis following it are characterized by their history, and by the excessive tenderness and pain over the region of the bones affected.

Treatment.—If the case is seen in the very earliest stage when the symptoms are those of obstruction, with some amount of tenderness and swelling in the region of the sac and slight febrile excitement, it may be possible to arrest the progress of the inflammation by putting on one or two leeches over the sac or within the nostril, applying afterwards the ice-bag continuously, or as long as the patient can bear it with a feeling of comfort. If, however, the superficial parts have become swollen, and it is evident that pus has already formed, it is better to open the sac without further delay. There are two ways of doing this. If the superficial swelling be moderate, and does not involve the lower eyelid to any great extent, it is a very good plan to lay open the lower canaliculus, or, if this cannot be conveniently reached, the upper canaliculus, and at the same time to carry the point of the knife on into the sac itself, freely dividing its outer wall on the conjunctival aspect. The late Sir William Bowman's canaliculus knife (*see* fig. 4) is an extremely convenient instrument for this purpose, and can be manipulated more easily than the canaliculus director and scalpel or cataract knife. In any case the sac must be opened freely, and we can be satisfied that this has been done only by seeing pus escape through the incision. It is often difficult to prevent this incision closing too soon, and this can be prevented only by passing a probe between its edges daily for three or four days after opening the abscess.

It is seldom that this method of operating can be carried out. The abscess may have so far ripened that the skin at the inner extremity of the lower eyelid is threatening to give way, or has become so far attenuated that it is hopeless to attempt to prevent its ulcerating sooner or later; or though there may be no pointing on the cheek, there may be so much swelling of the eyelids and the adjacent parts that it is impossible, without great pain to the patient, to reach the canaliculus and incise the sac through it. Hence the more usual plan is to make an incision into the sac at its most prominent part, below the tendo-oculi. A small scalpel, or long cataract knife, is the most convenient instrument for this purpose. Its point should be entered a little below the inner canthus and thrust nearly vertically downwards, but with a slight inclination towards the nose and somewhat backwards, so as to clear the lower margin of the orbit: on withdrawing it (which should not be done until matter is reached and escapes by the side of the blade), the incision should be enlarged to the extent of three lines, or a quarter of an inch, in a direction obliquely downwards and outwards. The patient should be lying down during this operation, with his head supported on a pillow, and the surgeon stands at the head of the couch behind him; or, if this be inconvenient, the patient may be seated on a low stool and the surgeon stands behind him, supporting his head against his chest and steadying his hand on the forehead of the patient.

The incision should be probed on the following day, and for two or three days subsequently, as it has a tendency to become united by the first intention, in consequence of the accurate adaptation of the parts, due to the great superficial swelling so often accompanying this affection.

The relief to the pain and discomfort by an early opening of an abscess of the sac is very marked, and hence this treatment is always to be advised, provided the diagnosis is clear and there are no contra-indications of another kind. If the abscess is allowed to break, it often leaves a ragged opening on the cheek, which takes a long time to heal, and perhaps forms a permanently fistulous opening.

As soon as the acute symptoms and swelling of the parts have subsided, means must be employed for restoring the perviousness of the natural passages. The canaliculus must be

laid open freely and kept patulous by passing a probe, and as soon as the extreme tenderness of the region of the sac has subsided, the lachrymal probe should be passed into the nose through the sac and nasal duct. A small probe only will pass in the first instance, and the passage must be dilated by gradually increasing the size of the probe employed. It is generally found that as soon as the natural passage becomes pervious, the opening on the cheek gradually closes up, but in some cases a permanent fistula remains, which will have to be dealt with by subsequent treatment.

SECTION IX.

Acute lachrymal pericystitis is a condition well recognised by all ophthalmic surgeons but not very clearly described till Dr. Parinaud's paper appeared in the *Annales d'Oculistique*, Mai-Juin, 1891.

In its typical form the swelling appears in the region of the sac, spreading in a short time laterally, but being confined chiefly to the immediate neighbourhood. At first there is only slight swelling of the part; but in about forty-eight hours superficial redness appears. In a few days there is perforation either through the skin or into the sac. Sometimes pus finds its way in both directions simultaneously or nearly so. If the skin alone is perforated there is often a burrowing of matter under the thinned margins of the aperture, and the resulting abscess may extend some distance in the cheek, generally towards the outer half of the orbitar margin.

The patients with pericystitis are most frequently women who have had obstruction of the tear-passages (chronic mucocele) for some years, and who very often suffer from recurrent attacks of inflammation at the menstrual periods. Many women also suffer at the menopause if they have had chronic mucocele or obstruction of the nasal duct. These frequent recurrent attacks of pericystitis, not always leading to abscess, are sometimes mistaken, according to Dr. Parinaud, for erysipelas, and there seems good reason for Parinaud's suggestion that the cavernous tissue forming a partial investment of the sac becomes congested in these patients at their monthly periods, and that the engorged vessels form the starting point of the recurrent attacks of pericystitis. Not unfrequently abscess forms and leads to a lachrymal fistula.

Diagnosis.—The diagnosis of pericystitis from dacryocystitis is not always easy unless the case is under observation in an early stage. The swelling has generally less defined margins and is more superficial in pericystitis than in dacryocystitis. It is not bound down by the horizontal depression of the tendo

oculi passing across it. When suppuration takes place there is a flat abscess burrowing under their skin and extending outwards or downwards.

The **treatment** consists *first* in restoring, if possible, the permeability of the nasal duct as quickly as possible before an abscess has formed, and next in opening any abscess that is clearly making its way to the surface, as soon as any pointing can be detected with certainty. Even if the abscess is making its way towards the sac it is an advantage to open it before it has reached that cavity. The incision in either case must be carried into the sac in a direction backwards, inwards and downwards. Antiseptic lotions are to be applied, and as soon as all swelling has subsided the canaliculus must be opened and probes passed through the obstructed duct.

The periosteal form of pericystitis offers some distinctive features. It is the result of periostitis in the bony walls of the sac, extending most commonly from the nasal part of the channel, upwards. It may be accompanied by little prominence of the immediate region of the sac and may show no tendency to the formation of abscess. There is pain more severe than in dacryocystitis, and excessive tenderness.

The swelling may extend along the margin of the orbit and towards the nasal bones. There is generally great lachrymation, restlessness, fever and sleeplessness. Tertiary syphilis is the most frequent cause. The treatment must be carefully conducted and a preliminary examination of the nasal fossæ is very necessary. Much thickening of the nasal mucous membrane is generally found, and perhaps ulceration. A course of iodide of potassium in large doses is necessary before the use of probes. When this and other medicines have proved successful, the mechanical dilatation of the sac and duct may be fitly carried out.

SECTION X.

Lachrymal fistula is generally the result of a neglected or imperfectly cured *lachrymal abscess*. If this be so, the first step in the treatment will be to ascertain the conditions of the sac as regards perviousness or the reverse. The constant overflow of tears on the cheek, and the regurgitation of pus or mucus on making pressure over the sac, will be the best evidence of obstruction in the nasal duct, short of actual probing. The treatment then consists in the various proceedings already described in the treatment of mucocele.

It is especially necessary to make use of the style in the treatment of fistula lachrymalis, and to continue its use until the fistulous opening has closed. It may be necessary to keep it in the sac and duct for six months or more, and the larger the style employed the better.

Author's Case of Lachrymal Fistula.

Mrs. T., aged 56, was the subject of lachrymal fistula, of old standing, in July, 1869. In August, 1869, after an operation for cataract, acute suppuration of the lachrymal sac came on, and copious mucous regurgitation on pressure, which continued till October. October 29th, the canaliculus laid open into the sac, its internal orifice being obstructed, and a large conical probe passed through the sac into the nasal duct. At the same time the edges of the fistula were pared and lunar caustic applied. Probes were passed every other day for a week, and a soft silver style inserted and retained for ten days, when regurgitation of mucus having disappeared, it was removed. A minute fistula still remained, but there was no overflow of tears. In March, 1870, five months after the removal of the style, a return of the fistulous discharge and swelling of the sac necessitated re-insertion of the style, and it was worn continuously for six weeks. During the last ten days I found that the fistula had closed by a firm cicatrix, and the overflow of tears had quite ceased. When seen a fortnight later, there was

no mucous regurgitation, and no epiphora, and the patient considered herself quite well.

If the fistula still remains open after the style has been in its place for some weeks, it is well to apply the solid lunar caustic to its edges, and reduce thereby any redundant granulations that may be interfering with the formation of a cicatricial union. This very often succeeds, but in very obstinate cases the electric cautery should be employed; the swelling of the adjacent parts caused by irritation of the cautery will sometimes bring the opposed edges more accurately into apposition, and at the same time adhesive inflammatory action is set up in the raw edges themselves, and a closure of the orifice is thus effected.

Sometimes the fistula is kept open by the protrusion of gelatinous-looking button-shaped granulations from the lining of the sac, and, when this is the case, the most effectual plan of operating is to dissect the skin carefully around the aperture, laying it open freely, to remove a portion of the anterior wall of the sac with its granulations, and to apply the solid caustic to the interior. The edges of the skin can then be brought together by one or two sutures, and Dr. Richardson's styptic colloid or collodion and cotton-wool applied over the wound. In no case can the fistula be expected to close, unless the passage through the sac and nasal duct has been thoroughly re-established, Formerly lachrymal fistula was the result of wearing a style but the modern method of passing the style through the mucous aspect of the lower eyelid has made this form of fistula a mere historical curiosity.

SECTION XI.

Polypi of the lachrymal sac are very rare. I had under my care a woman of about forty-five years of age, with a chronic obstruction to the passage of the tears through the right lachrymal sac and duct, which I suspected to be due to the presence of a polypus partly within the sac. I frequently passed the lachrymal probes into the sac, and the patient wore a style for several months with great benefit; but, notwithstanding some temporary relief, the overflow of tears returned, and when I last probed the duct there was a sensation as of some soft compressible body occupying the passage. The patient tells me that she formerly had a polypus or polypi removed from the nostril, and on examining the nostril, a yellowish glistening body is visible in the lower meatus, though the nostril itself is not obstructed by it. Should this prove to be a polypus in the sac, there will ultimately be considerable protrusion of its walls, and, in all probability, some external tumour and abscess presenting on the cheek.

At p. 136 of M. Gerdy's work, *Des Polypes*, a case is recorded of a woman, thirty-two years of age, who had had symptoms of mucocele for several years, but no abscess. A tumour was felt in the region of the sac; the latter was cut into, and a polypus of the size of a filbert removed. It was attached to the anterior wall of the sac (see *Radius, Scriptores Ophthalmologici Minores*, vol. ii., p. 139, Lipsiæ, 1828. See also another case of lachrymal polypus, related by Janin, in his *Mémoires et Observations sur l'Œil*," p. 299, Lyon, 1772).

SECTION XII.

Calculi and foreign bodies in the excreting lachrymal passages. – Several cases are quoted in systematic works on ophthalmology, and the following by Mackenzie from the *Philosophical Transactions* or Lowthorp's *Abridgment*, vol. iii., part i., p. 40, is perhaps equal, if not superior, to any other recorded instances in its marvellous circumstances and details:—

"A saddler's daughter had an imposthume, which broke in the corner of one of her eyes. Out of it there came about thirty stones as big as pearls, and splendid; after which she had a fistula, which was cured by Turberville, under whose care the patient was." Could this have been a case of epithelioma containing "globes epidermiques" or "cancroid pearls?"

Dr. Krimer relates the following case (Gräfe and Walther's *Journal der Chirurgie und Augenheilkunde*, vol. x., p. 597, Berlin, 1827), which very closely resembles the case reported on by Dr. Bristowe, in the *Pathological Transactions* (*see* Section II., Subsection 6).

Case.—A woman had for nine months been affected with disease of the excreting lachrymal organs. The sac was swollen, hard, and upon the most prominent part of the tumour, which was red and painful, there was a small ulcer, which penetrated into the sac, and discharged pus, mixed with tears, especially on pressure. The nasal duct appeared entirely obliterated. When, in order to re-establish it, Dr. Krimer endeavoured to introduce a pointed probe, he withdrew on its extremity a concretion of the size of a small pea, the removal of which left the canal entirely free, and the fistula was promptly cured. The calculus was ash-grey, covered with thick mucus, polished, of a calcareous appearance, and insoluble in water, alcohol, and weak vinegar. Dr. Krimer thinks that it was formed in the lachrymal sac by inspissated mucus.

In one of my cases I found a small greenish body, of about the size of a split pea, and in external appearance not unlike a small pea, situated in the upper part of the lachrymal sac. It was easily removed by making a small incision, and when cut

across presented the appearance of hard putty, the earthy matter being held together by hardened mucus.

The foreign bodies in the lachrymal excreting canals have been generally styles that have sunk into the fistula and become buried in the skin, which may even heal over them, and so disguise the source of the troublesome overflow of the tears and mucocele which results from its presence.

If the presence of a style be suspected, the lower end of it may possibly be felt in the inferior meatus of the nostril by means of a probe, and if it be lying loose it may even be extracted through that aperture. The more usual and more effectual way of dealing with such a case is to cut down upon the supposed position of the foreign body in the region of the sac, and to seize and extract it by drawing it upwards through the aperture thus made.

SECTION XIII.

The Use of Antiseptics and Anæsthetics in the Treatment of Diseases of the Lachrymal Passages.

A. **Antiseptics.**—Much of the treatment of diseases of the lachrymal passages is surgical. *Antiseptics* are consequently much used, both at the time of operations and in the after-treatment. Their use, however, can only be undertaken with certain precautions. Absolute asepticism in the treatment of passages, which are in direct communication with superficial mucous surfaces and with the principal respiratory channels, is out of the question, but it is of the greatest importance that the instruments, appliances, and dressings used, should be perfectly *aseptic*. This can be effected by immersing the instruments and appliances in boiling hot water, and by having the dressings impregnated with perchloride of mercury solution (1 part in 5000), or in solution of boric acid (saturated solution). For application to the conjunctival surfaces, antiseptic solutions must of course be much weaker than when they can be injected by the modified Anel's syringe into the sac. Great advantage may be derived from the application by means of a syringe to the interior of the sac of strong boric acid (gr. x. to $\frac{3}{3}$ j.) solution, but the cases in which carbolic acid solutions can be so applied are very rare. The regurgitation from the sac of carbolic acid solution is very irritating to the conjunctival membrane and to the cornea. Hence, if it be necessary to inject sol. carbolic, it must be so applied that it passes well through into the nose, and is not allowed to escape upwards.

Perchloride solution of 1 in 5000 is not at all dangerous to the eye, and may be used to inject into the sac, or as a lotion to be dropped into the inner canthus, when the sac is obstructed partially or even completely.

It facilitates the access of lotions to the interior of the sac, if at the time of using them the lower lid be gently drawn outwards and forwards, and then released, doing this alternately several times, and allowing the edges of the divided canaliculus

to be opened and shut in alternate movements. A sort of pumping action is thus induced, favourable to the downward passage of the lotion.

B. **Anæsthetics, general and local.**—Many of the surgical proceedings in these passages are much facilitated by the use of a general anæsthetic, and I am sometimes compelled to employ such anæsthetics in the case of young children and timid adults of either sex; but cocaine properly applied is becoming every day more useful for slight operations on these parts, which must in many cases be frequently repeated. In operating for the division of the canaliculus, cocaine solution (four per cent.) acts very well. It should be applied at intervals of forty seconds, six times, in order to be thoroughly effectual. A much longer time is required for the anæsthetising of the canaliculus than for the same effect on the cornea, or on the other regions of the conjunctiva. For probing the canaliculi the same method is sufficient.

When there is acute inflammation of the skin, as in many cases of abscess of the sac, the local effects of cocaine are little or not at all effectual, and the same applies to inflammatory affections of the sac, even when the skin is not involved. The operation of opening the sac seems to give as much pain after cocaine as without its use.

Opening the sac through the conjunctival surface is also, I think, as painful after as without the use of this very useful drug. So that in these cases, especially when the patient is a child or delicate adult, a general anæsthetic is desirable, and for this purpose nitrous oxide gas is admirably adapted, and gives the operator quite sufficient time.

For probing the sac and duct cocaine gives very good results, if applied in the following way:—(1). A 4 per cent. solution is applied three or four times as directed for the canaliculus operation. (2). A stronger solution (8 per cent.) with 1 per cent. of carbolic acid is then injected into the sac by means of the syringe depicted in fig. 8 (*see* Section VII., *supra*). (3). At the same time a plug of cotton-wool, saturated with a 20 per cent. solution of cocaine with 1 per cent. of carbolic acid is passed into the nasal fossa of the same side as that operated on and allowed to remain in the inferior meatus for about three minutes, or until the patient experiences a decided numbing sensation in

the parts. Probes can then be passed through the sac and duct without pain. Even large conical probes may be forcibly thrust through the obstructing constrictions, fibrous or bony, without any expressions of pain being manifested. It seems that the carbolic acid added to the cocaine increases its anæsthetic effects very considerably. In the act of injecting the sac with the syringe care must be taken that the solution containing the carbolic acid does not escape on to the conjunctiva and cornea, as the acid is very irritating to these parts.

As it is necessary to repeat the operation of passing a probe through the nasal duct, sometimes daily for many weeks, it is of course not desirable to repeat the above somewhat troublesome applications on each occasion, nor indeed is it necessary, for after the first two or three times the probe passes so easily, and the passages become so freely accessible, that the mere dropping of a 4 per cent. cocaine solution into the inner canthus of the eye is sufficient in many cases, and in others this may be supplemented by the injection of the cavity of the sac by means of the syringe with the same (4 per cent.) solution. The use of the intra-nasal pledget of cotton-wool is not under these circumstances required.

For the purpose of more severe operations on the sac, a general anæsthetic is necessary, and I think the *A.C.E.* mixture is preferable to chloroform alone or ether alone. Nitrous oxide gas gives scarcely sufficient time for such an operation as that of laying open the sac and cauterizing it or scraping out granulations, or removing polypi or foreign bodies. It may, however, be used for these longer operations when the anæsthesia is prolonged by the administration of ether after the gas.

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