DACRYOCYSTITIS IN INFANCY*

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DACRYOCYSTITIS in infants occurs as the result of an obstruction at the lower end of the naso-lacrimal duct which may be developmental or acquired in origin, and the treatment will depend upon the nature of this obstruction.

It has been amply demonstrated that the last portion of the naso-lacrimal duct to become canalized is the point of coalescence between the nasal sprout of the mother cord of the developing lacrimal duct and the nasal mucous membrane. This stage may be delayed until term or later in up to 35 per cent. of cases (Schwarz, 1935), and a figure as high as 73 per cent. has been found by Cassady (1952).

The relationship between infantile dacryocystitis and delayed development of the naso-lacrimal duct was first suggested by Peters (1891), Rochon-Duvigneaud (1899), Stephenson (1899), and Gunn (1900), and it is now generally believed that this condition is the direct result of the failure of the membrane at the lower end of the naso-lacrimal duct to rupture at birth (Krämer, 1922; Crigler, 1923; Cassady, 1948a, b; Duke-Elder, 1952; Mann, 1957; and many others). As Cassady (1948b) stated,

“The lumen is usually established by rupture of this membrane before tears start, but if it is not, the sac distends, becomes infected, and dacryocystitis of infancy occurs.”

It is, however, possible that infantile dacryocystitis is the direct result of infection itself at or soon after birth, and Simpson (1945) was firmly of the opinion that inflammation and oedema of the naso-lacrimal duct, secondary to nasal infection, was the cause of a large number of cases. He suggested that infection caused obstruction by itself, or fostered the formation of a mucoid or muco-purulent plug.

An epithelial plug, representing a failure of the central epithelial cells to separate and become necrotic, has also been suggested (Riser, 1935; Harman, 1938; and others). However, this state of affairs, if indeed it is possible, is directly related to delayed development of the naso-lacrimal duct itself.

Although, as has been stated, it is generally assumed that the presence of a developmental membrane at the lower end of the naso-lacrimal duct is the

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cause of infantile dacryocystitis, there are conflicting views as to how it should be treated. Cassady (1948a), in an extensive review of the literature, found fifteen papers which recommended early probing and eighteen which favoured conservative treatment with local antiseptics and massage. However, more recent publications do, on the whole, advocate early probing.

Those who advocate early probing believe that the developmental membrane causing the disease should be ruptured early, while those who favour conservative methods believe that the membrane will rupture spontaneously.

The natural course of this disease is difficult to determine. However, Price (1947), reviewing 203 cases, 192 of which recovered following conservative treatment, found that 149 (77.6 per cent.) had recovered by 3 months of age, 26 more (13.5 per cent.) by 6 months, a further twelve (6.3 per cent.) after one year, and five (2.6 per cent.) by the end of the second year. Eleven cases did not recover on a conservative regime and required probing of the naso-lacrimal ducts.

The end result of the disease is also difficult to determine. Crigler (1923) claimed to have had no failures in 7 years following a conservative regime, and Nelson (1953), who advocated probing before the age of 2 months, claimed to have had no failures in 25 years. However, few surgeons nowadays would claim 100 per cent. success with either conservative or radical treatment, and it is well recognized that dacryocystorhinostomy is sometimes required, whatever method of treatment is employed (Koke, 1950; Blankstein, 1952; Evans, 1956; Dena, 1958).

Summerskill (1952) estimated that 2 per cent. of cases of congenital dacryocystitis are not cured by probing; Koke (1950), reviewing 116 infants of whom 102 were probed, found three cases that required further surgery; Evans (1956), reviewing 126 cases of which 78 were probed and the remainder treated conservatively, also found three cases which required surgery.

Although the majority of cases are eventually cured, there may be a number of patients with varying degrees of residual stenosis of the lacrimal duct in whom symptoms, although not usually present, occur with greater frequency and facility than normal, even after probing. Schaeffer (1912) believed that "all disease processes in infants and in adults which lead to either a partial or complete obstruction of the lumen of the lacrimal canal are in a measure contingent on irregular or defective canalization". Although Duke-Elder (1952), considered this to be an over-statement, there is no doubt that after infantile dacryocystitis a child may be left with symptoms of occasional epiphora especially out-of-doors in cold or windy weather, or when he has a head cold, for many years if not permanently, and it is likely in these cases that incomplete canalization with a residual stenosis of the naso-lacrimal duct does, in fact, persist.

It has been the practice at the Children's Hospital, Sheffield, to probe patients with symptoms of infantile dacryocystitis early, without carrying out prolonged conservative treatment, unless the symptoms are obviously

improving by the time they are first seen at the hospital, and this study has been undertaken in order to review the nature of dacryocystitis and to assess the value of early probing in the treatment of this condition.

Clinical Material

This report is based on a total of 437 cases of infantile dacryocystitis seen at the Children's Hospital, Sheffield, over a 5-year period from June, 1955, to June, 1960. Only those babies in whom symptoms occurred in the first year of life have been included.

The age at which patients first attended the out-patient clinic is shown in Fig. 1.

FIG. 1.—Age distribution of 437 patients referred to hospital with infantile dacryocystitis.

The majority are referred between 2 and 5 months of age, but a large number are not seen until after the age of 6 months, and a few not until well after the age of 1 year.

The normal procedure in such cases is as follows:

When a patient is referred with symptoms of infantile dacryocystitis, antibiotic drops are given for use at home and the patient returns for probing 1 or 2 weeks later. Routine culture is not usually performed.

Method of Probing

Both eyes are probed as a routine in all cases, under general open ether anaesthesia, because of the high incidence of bilateral cases.

The inferior lacrimal puncta are dilated carefully with a Nettleship's dilator; as excessive dilatation of the punctum will remain permanently, great care must be taken with very young babies not to slit the canaliculus with excessive force. No. 3 size Leibrich lacrimal probes, dipped in sterile liquid paraffin, are passed along the lower canaliculus and through the naso-lacrimal ducts until passage is

felt into the nose. The probes are then left *in situ* for several seconds. An obstruction can usually be felt at the lower end of the duct and less frequently at the entrance to the sac. If there is a firm obstruction at the entrance to the sac, the probes are passed through the upper canaliculus. If No. 3 size probes cannot be passed, an attempt is made with smaller sizes (No. 2 or No. 1).

Local antibiotics are continued at home until the symptoms clear. This may occur immediately and is usually evident by the next visit in 2 weeks' time. If symptoms persist for between 1 and 2 months, especially if a discharge is still present, the ducts are re-probed. The ducts are not syringed.

Results

44 out of a total of 437 cases treated in this way did not require probing, four cases first seen at 1 month were probed at 3 months of age, and eight seen between 3 and 7 months of age were probed 1 month later, conservative measures having proved unsuccessful.

386 cases were probed, 305 being probed once, 64 twice, and seventeen three times or more.

Seven cases presented with a lacrimal abscess and these have been reported elsewhere (Ffooks, 1961).

The series of patients was reviewed in November, 1960; 94 were not traced and have been excluded, leaving a total of 343 cases to be reviewed.

Incidence.—Published figures of the incidence rate are few. Stephenson (1899) found an incidence of 1·75 per cent. in 1,538 out-patients at a Children's Hospital. Cassady (1948b) found an incidence of 5 per cent. in 279 consecutive births, and Kendig and Guerry (1950) an incidence of 5·7 per cent. in 1,000 consecutive births; Nordlöw and Vennerholm (1953) suggested a figure as low as 0·5 per cent.

In the present report, 437 cases were seen over a 5-year period from June, 1955, until June, 1960, giving an incidence of 87·4 cases per annum, and it is estimated that 90 per cent. of all infants with dacryocystitis that have been referred to hospitals in Sheffield during that time have been included in this series.

From this figure it has been estimated that approximately 1·2 per cent. of newborn babies are eventually referred to hospital with symptoms of infantile dacryocystitis.

Sex.—Of the total series, 224 were girls and 213 were boys. This proportion is not very different from the normal ratio and is not considered significant; it may be compared with the 51 per cent. boys and 48 per cent. girls found by Nordlöw and Vennerholm (1953).

Onset of Symptoms.—It has long been recognized that symptoms may be present at or soon after birth (Stephenson, 1899; Gunn, 1900).

Kendig and Guerry (1948) observed the onset of epiphora between 10 and 12 days in most cases, and Cassady (1948a), reviewing 100 cases, found that the onset of symptoms occurred before the 10th day in 85 per cent. of his cases: in the other 15 per cent. symptoms began between 1 and 18 months after birth.

Koke (1950), reviewing 116 infants, found that symptoms began at birth or within a few days of birth in all cases. Nordlöw and Vennerholm (1953),

reviewing 100 cases over a 10-year period, found that 84 per cent. developed symptoms within the first month, and the remainder up to 13 months of age.

Symptoms are frequently bilateral. Cassady (1948a) found that 14 per cent. of his cases had bilateral symptoms, and Broggi (1959), reviewing 101 cases, found bilateral symptoms in about 20 per cent. of his cases.

In the present review of 343 patients, the age at onset of symptoms is shown in Table I.

TABLE I
ONSET OF SYMPTOMS IN 343 CASES OF INFANTILE DACRYOCYSTITIS

Age at Onset	No. of Cases	Original Symptom	
		Discharge	Epiphora
0-1 wk	188	145	43
1-2 wks	38	21	17
2-4 wks	31	15	16
1-2 mths	26	12	14
2-4 mths	30	10	20
4-6 mths	4	1	3
After 6 mths	3	1	2
Indefinite at Birth	23	13	10
Total	343	218	125

Symptoms were noted within the first 6 days of life in 188 cases (54.8 per cent.) and within the first 3 days of life in 158 cases (49.4 per cent.) and 27 cases showed symptoms on the day of birth (Fig. 2, opposite). A further 69 cases showed symptoms within one month of birth, 26 between 1 and 2 months, thirty between 2 and 4 months, and seven at later periods. The onset in 23 cases was stated to be indefinitely "at birth".

Symptoms were bilateral in 116 cases (33.8 per cent.).

Symptoms.—In the large majority of cases the symptoms are either watering eyes, or discharge, or both. Purulent regurgitation is frequently present on pressure over the lacrimal sac, depending on the degree of discharge present. Koke (1950), however, found regurgitation present in all cases. Occasionally a mucocele may be present at birth, which may go on to abscess formation or regress spontaneously (Morgan, 1938).

Epiphora, once present, remains more or less constant, but varies in degree in different cases. If epiphora is not severe, symptoms may be present only out of doors or in a cold wind, or always with a head cold—the symptoms here probably depending on a partial stenosis of the duct which easily becomes blocked, rather than complete occlusion with mild symptoms.

The amount of discharge varies in severity from "sticky eyes since birth" or "eyes occasionally stuck up in the mornings" to a constant discharge which the mother is perpetually wiping away.

FIG. 2.—Onset of symptoms in 188 cases occurring within 1st week after birth.

The amount of discharge can often be controlled temporarily with antibiotics, but on cessation of the treatment it is liable to recur. Descriptions such as “recurrent conjunctivitis that has failed to respond to treatment with successive antibiotics” are frequent, although one must remember that an initial conjunctivitis may, in fact, have been the original cause of the dacryocystitis.

Of the 343 cases under review, discharge was said to be the first symptom in 217 cases and epiphora in 126 (Table I); discharge was the only symptom in 146 and epiphora the only complaint in sixty.

It should be noted that epiphora may occur at any time after birth and frequently does so, especially if there is reflex stimulation from infection of the lacrimal passages. In fact epiphora occurred as the first symptom within the first week in 43 cases and within 3 days of birth in 35 cases (Fig. 2).

However, in the first week, discharge occurs much more frequently as the first symptom (Fig. 2); 145 such cases occurred within a week of birth and 123 of these in the first 3 days, discharge being present on the day of birth in nineteen cases. The difference in time between the onset of the original symptoms of discharge or epiphora is illustrated in Table I, which shows the preponderance of discharge in the cases with early onset.

Results of Treatment.—These are summarized in Table II (overleaf). Seven cases which presented with lacrimal abscess and have been reported elsewhere (Ffooks, 1961) have been excluded, as also have two patients with absent inferior puncta, leaving a total of 334 cases to be reviewed; 244 cases were probed once, fifty twice, and thirteen three times or more; 27 did not require probing.

270 patients have been rendered free of all symptoms but 64 still complained of various symptoms when reviewed in November, 1960. One patient required

TABLE II
RESULTS OF TREATMENT IN 334 CASES OF INFANTILE DACRYOCYSTITIS

No. of Times Probed	No. of Cases	Results		
		No. of Cases Cured	No. of Cases Not Cured	No. of Cases with Residual Stenosis
0	27	26	—	1
1	244	229	3	12
2	50	43	1	6
3	13	11	1	1
Total	334	309	5	20

dacryocystorhinostomy at the age of 2 years and is now cured. Four still had constant epiphora and their ducts were found to be blocked on re-probing, and may need surgery at some later date. Twenty had moderate symptoms (fifteen in cold or windy weather, and five occasional discharge and epiphora). It is believed that these patients have a mild stenosis of the naso-lacrimal duct and they have not been re-probed.

Twenty cases had symptoms which were considered to be mild, having epiphora and discharge only with a severe head cold, and nineteen had had symptoms with a heavy cold but had been free of all symptoms for some time when reviewed. These 39 cases are considered to be normal, although it is possible that there may still be a minimal degree of stenosis.

Of the 307 patients who were subjected to probing, 283 were cured, 229 with one probing, 43 with two probings, and eleven with three or more probings. Five (1.6 per cent.) still had a lacrimal obstruction, and nineteen (6.1 per cent.) had a residual degree of lacrimal stenosis, whereas, of the 27 patients treated conservatively, *i.e.* those whose symptoms were improving when first seen, one (3.7 per cent.) still has symptoms of stenosis.

The age at which the patients were first probed is shown in Fig. 3 (opposite), from which some interesting points arise:

(1) The cases treated successfully by conservative methods are in the younger age groups.

(2) There is a slight increase in the average age of those requiring two or more probings, but there are several patients under the age of 3 months who also required two or more probings.

(3) It can be seen that in patients under 12 months of age there seems to be little relationship between the age at which probing is first performed and the final result; the majority of persistent symptoms occur in children first probed when under 5 months of age. However, with children first probed after the age of one year, there is a greater frequency of failure.

(4) As Larsson (1938) noted, "in the older children rapid cure with probing often results"; although a larger proportion of these older children need more than one

FIG. 3.—Results in 334 cases of infantile dacryocystitis, showing age at first probing.

probing it is by no means uncommon for children over 9 months of age to be cured by a single probing.

Fig. 4 shows the proportion of cases cured by a single probing; it is not until after 4 months of age that there is any appreciable fall in the success rate judged by this means. This is also shown graphically in Fig. 5 (overleaf).

FIG. 4.—Proportion of cases of infantile dacryocystitis cured by a single probing.

FIG. 5.—Percentage of infants cured by a single probing.

Discussion

Aetiology.—Although between 30 and 75 per cent. of infants' nasal lacrimal ducts may be imperforate at birth, it is clear that canalization proceeds normally in the large majority of cases, as the incidence of infantile dacryocystitis is very much less than this figure, varying between 0.5 and 5 per cent. From these figures alone, it would appear that developmental factors are not primarily important in the aetiology of this condition, but that some other factor is responsible for preventing this relatively small percentage of cases from developing normally. It would seem that neonatal infection is more likely to be the main factor in the aetiology of infantile dacryocystitis.

It has been stressed that a high proportion of babies' noses become colonized with staphylococci during the first few days of life (Cunliffe, 1949; Gillespie, Simpson, and Tozer, 1958; Jennison and Komrower, 1961; and Elias-Jones, Gordon, and Whittaker, 1961), and that between 64 and 100 per cent. of babies become nasal carriers by the end of the first week.

The high incidence of conjunctival infections in newborn babies is well recognized.

Recent reports suggest that between 4 and 10 per cent. of all infants develop eye infection within 2 weeks of birth (Forfar, Balf, Elias-Jones, and Edmunds, 1953; Crosse and Mackintosh, 1953; Jennison and Komrower, 1961; Elias-Jones and others, 1961), although a figure as high as 17.6 per cent. was found by Corner (1946). The incidence of staphylococcal infection in neonatal conjunctivitis was reported as 48 per cent. by Gillespie and others (1958) and as 80 per cent. by Forfar and others (1953).

The onset of symptoms of infantile dacryocystitis occurs in the majority of cases within the first week of birth, and in most within the first 3 days: it would seem highly probable that these symptoms are simply the result of neonatal infection of the conjunctivae or lacrimal passages, and it is suggested that it is this infection which is the primary cause of infantile dacryocystitis.

However, the onset of symptoms may also develop with decreasing frequency over the ensuing months. In 37 cases in this series, symptoms did not begin until after the age of 2 months (Table I). As canalization should be complete within a month of birth and normal tear production should have started by then, these cases must be the result of infection of the lacrimal passages and cannot at this age be due to delayed development as epiphora was not present beforehand. Cassady (1948a) believed that these cases of later onset are the result of infection supervening on a stenosis of the lacrimal passages.

In some cases epiphora is the first symptom, but this does not preclude previous infection. The average age at onset of lacrimation is about 3 weeks (Cassady, 1948b) and the presence of epiphora within a week of birth is likely to be a reflex production from inflammation of the lacrimal sac.

In some cases epiphora is the only symptom, discharge never being present, but these are few and the age at onset of symptoms is usually later than 1 month after birth. It is possible that, in these cases, also, mild inflammatory oedema at the nasal end of the lacrimal duct is sufficient to cause obstruction and reflex lacrimation.

That delayed development may be the direct cause of infantile dacryocystitis in a number of cases is probable. In cases presenting with a mucocele at or shortly after birth, this is probably due to a dilated lacrimal sac and duct occurring before birth through delayed development of the naso-lacrimal duct, as has been demonstrated by Schwarz (1935). However, it is my opinion that infection should be given precedence in the aetiology of congenital dacryocystitis and that, although two processes, developmental and infective, may frequently be combined in a dual pathology, developmental anomalies play a secondary role. It is suggested that the usual mechanism is as follows:

Infection occurs in a naso-lacrimal duct that may remain imperforate at birth. The ensuing inflammatory reaction converts the thin developmental membrane at the lower end of the naso-lacrimal duct into a thin fibrous membrane, thus arresting the final development of the naso-lacrimal duct. If infection can be prevented entirely, normal canalization will occur. If the infection is mild and can be controlled early enough and for long enough, the developmental membrane may break down naturally at a later date.

However, if infection is not adequately controlled in the early stages, the obstruction will remain until removed by mechanical means; this obstruction will still be a fibrous membrane and easily cured by probing up to about 9 months of age, as long as severe and repeated infections do not occur.

If the original infection is severe and the inflammatory reaction marked, the lower end of the naso-lacrimal duct is liable to become irretrievably blocked by fibrosis and periosteal reaction may be marked, giving rise to the so-called "bony changes" recognized on probing. The whole duct may

become occluded entirely, as demonstrated by Waldapfel (1954). Repeated infection then occurs and the lacrimal sac becomes more dilated, with marked discharge and regurgitation.

It has been suggested that staphylococci acquired by infants in hospital are more likely to produce virulent infections than those acquired outside, and it is interesting to note that, of fifteen children requiring three or more probings, fourteen (93·3 per cent.) were born in hospital, and of fifty children probed twice, 26 (52 per cent.) were born in hospital, and 53·7 per cent. of all infants with symptoms occurring within 2 weeks of birth were born in hospital.

Treatment.—The large variations in the reported incidence of this disease can be related to the age at which patients are first seen.

At birth between 5 and 10 per cent. of babies have symptoms of infantile dacryocystitis or neonatal conjunctivitis, but after a few months this figure drops to somewhere between 0·5 and 1·5 per cent.

If these figures are correct, it would appear that 80 to 90 per cent. of babies with sticky eyes shortly after birth become free of symptoms within about 3 months by following simple conservative measures, and this figure agrees very closely with that of Price (1947).

Thus, in about 10 to 20 per cent. of cases, cure does not occur within the first few months, and because of this it has been advocated that probing of the naso-lacrimal duct should be done early, that is by 2 months of age or before (Cassady, 1948a, b; Koke, 1950; Nelson, 1953; Broggi, 1959), mainly in the belief that dacryocystitis is due primarily to delayed development and that permanent obstruction of the naso-lacrimal duct is likely to occur more frequently with prolonged delay. It does appear (Fig. 3) that probing is more likely to be successful if performed before the age of 4 months, and although there is no statistically significant difference in the present figures, cure more frequently follows a single probing if it is performed before the age of 4 months (Fig. 4). There does not seem to be any greater success if probing is done much earlier, and there is no doubt that the cases which clear spontaneously are very much more numerous in the first 3 months.

The arguments for earlier probing are that it saves the mother the trouble of repeated visits to the doctor, and that the obstruction may become permanent. That the latter is not very likely is seen from the large number of cases that are cured even if they are not seen until after 6 months of age, or even (in three instances) after 3 or 4 years. That they may be required to be probed more than once is true, but eventual cure seems probable before the age of one year.

This apparently anomalous position is probably due to the original infection and the degree of fibrosis produced. It is well known in clinical practice that the most difficult cases to cure are those in which the discharge is greatest. The one case in which a dacryocystorhinostomy was necessary in this series

had had a profuse purulent discharge from the time she was first seen at the age of 4 months.

If infection is the cause of the majority of cases of infantile dacryocystitis, as has been suggested, strenuous measures should be taken to prevent ocular infection at birth and prophylactic nasal antibiotics as advocated by Jennison and Komrower (1961) may be advisable. Also, rapid and continued control of infection by means of suitable antibiotics is necessary, and it is important that severe infections of the lacrimal sac should be treated rigorously. The large majority of mild infections clear shortly after birth, but it is advisable that ducts remaining blocked at the age of 4 months should be probed, as this procedure is usually sufficient to clear the obstruction, provide drainage, and prevent further infection; but it is most important to bring the infection under control before the ducts are probed.

However, probing will not cure all cases and, unless infection can be prevented entirely, a small proportion will be left with permanent stenosis of the lacrimal duct.

Conclusion

It is considered that infantile dacryocystitis is caused in the large majority of cases by infection of the lacrimal passages occurring shortly after birth. It is thought that infection acts specifically by interfering with the developmental membrane at the lower end of the naso-lacrimal duct, thus preventing normal canalization. Symptoms of dacryocystitis usually develop within a week of birth, and up to 10 per cent. of infants develop signs of ocular or lacrimal infection at birth, but less than 20 per cent. of those affected, or 1 per cent. of all infants, need to be referred to hospital for treatment.

The disease is not, however, entirely confined to the neonatal period.

It is suggested that the primary treatment of this condition should be the control of infection at birth.

It is considered that no hard-and-fast rule can be given as to the duration of conservative treatment, but it is felt that probing should be done between 3 to 4 months of age. Earlier probing does not have any greater success, nor does the cure rate from probing decrease markedly until after the age of 9 months.

As so often happens with two controversial theories about the aetiology and treatment of a disease, it is found that both are in part correct. Infective and developmental factors together comprise the cause, and conservative measures and probing together comprise the treatment of infantile dacryocystitis. It is simply a matter of emphasis in the aetiology and timing in the treatment.

Summary

A report is presented of 437 cases of infantile dacryocystitis.

Infection is considered to be the main factor in the aetiology of this condition.

The results of probing long-standing cases are assessed, and it is considered that the optimum time for probing is between 3 and 4 months of age.

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