WHENEVER one speaks about diphtheritic conjunctivitis, one immediately thinks of a pseudo-membranous production that covers the tarsal conjunctiva and adheres to it more or less tightly. There is, however, another form of diphtheritic conjunctivitis, less frequent certainly, but nevertheless, quite as real as the former; the catarrhal form, which, although it may be met with at any time of life, usually affects the newly-born child and may, consequently, be ranged among the ophthalmias neonatorum.

Clinical Observations

Case 1.—B. G. was born prematurely after 7 months, on January 20, 1931, and, since her birth, she has shown rather an accentuated rhinitis.

On January 28, a slight muco-purulent secretion of the left eye was noticed and protargol was instilled several times.

On January 30, the secretion disappeared, only to reappear by March 15 affecting both eyes. Notwithstanding fresh instillations of protargol, the state remained unaltered up to April 6, when the existence of a growing small whitish stain on the inner inferior
part of the left cornea induced the parents to bring us the child on April 10.

At that moment, the left eye presented a large and very deep ulcer, which extended concentrically to the limbus and occupied the greater part of the inner-lower portion of the cornea and was about 4 by 5 mm. (Fig. 1.)

It was surrounded with a dense stripe of grey infiltration, that was uniformly marked on all its circumference. The slightly less opaque, grey-yellowish background looked as if it had been punched out. Its edge was separated from the limbus by a narrow strip of intact cornea.

Besides the ulcer, the cornea had lost its brilliancy and had a dull, dry and opalescent aspect. It was, nevertheless, possible to see that the pupil was obstructed by exudations and that there existed a very thick, but not copious, hypopyon.

The bulbar conjunctiva was congested. The ciliary injection was only slightly marked. A clot of pus had amalgamated into the inner canthus of the eye and a few filaments lingered in the lower fornix. The eyelids showed slight oedema. There was no dacryocystitis.

The microscopic examination of the greyish exudation of the ulcer edge, as well as that of the conjunctival secretions, showed the presence of Gram-positive diplococci. Consequently, it seemed to be a pneumococcal ulcer.

We prescribed instillations of atropine and applications of collargol ointment together with a bandage and a 2 c.c. injection of milk, which was repeated on April 12.

The right eye presented only a slight injection of the palpebral conjunctiva; the bulbar conjunctiva was white. A small quantity of pus had accumulated into the inner canthus of the eye. There was no dacryocystitis.

On April 14, the ulcer of the cornea showed signs of imminent perforation. Descemet's membrane, which was denuded, was undoubtedly ectatic.

On April 18, the ulcer had perforated and the iris was enclosed in the aperture, forming a hernia under the shape of a small, blackish cyst; the remainder of the cornea was completely opaque. In the evening the crystalline lens was found in the lower fornix.

On April 27, the perilimbal part of the bulbar conjunctiva presented a peculiar aspect in the lower half of the right eye; it was slightly swollen, dull and opaque; it was covered with a whitish coating, that overlapped the cornea to a certain extent; this coating, which seemed to consist of an extremely flimsy froth, was easily taken away, but reappeared quickly; the surface of the conjunctiva did not retain that wet and shining brilliancy, which is usual, and tears did not seem to moisten it any longer.
Thinking of xerosis, we examined the coating with the aid of the microscope and found motionless and Gram-positive diphtherimorph bacilli, showing a fragmentary colouration, as well as Neisser’s polar bodies.

On solidified serum they gave, after 24 hours’ incubation, numerous dry colonies, as large as the head of a pin, raised, roundish, white-greyish and with neat edges. They were more opaque in their centre than in their periphery.

They grew with more difficulty on gelose; they did not liquify gelatine, did not grow on potatoes nor did they coagulate milk. They troubled the broth and produced acid therein. They thrived in absence of air and fermented the glucose. They were possessed of a haemolytic power.

We injected a guinea-pig, weighing 350 gr., with 0.5 c.c. of the broth culture, 24 hours old; a viscous oedema was produced at the point of injection; that oedema was followed by an eschar. A few signs of toxi-infection followed: progressive loss of weight, rise of temperature (up to 39-2°C.) prostration. At last the animal died after 10 days (it then weighed 290 gr. only). The post-mortem examination did not reveal any characteristic lesion.

As the virulence of the bacillus did not seem to be much accentuated and as a mere nocive influence of the toxins, freed by the destruction of the injected microbes, might have been feared, we inoculated another guinea-pig, which had previously received an injection of antidiphtheritic serum; no reaction, either local or general, took place.

Consequently the diphtherimorph bacillus is a genuine diphtheriticus one.

The conjunctival secretion, besides numerous bacilli, contained a few Gram-positive diplococci. They were easily grown on gelose, to which serum had been added, and they gave birth to a thin sowing of dot-shaped and transparent colonies; they did not liquify gelatine and did not grow on potatoes. In broth they produced a slight cloud, gradually disappearing by way of sedimentation. They coagulated milk rather tardily. They were dissolved by ox-gall, and, when injected under the skin of a mouse, they killed the latter after 48 hours.

Consequently pneumococci had associated with Loeffler’s bacilli.

As we were dealing with an ocular diphtheria, on May 4 we effected a first injection of 5,000 units of antidiphtheritic serum and another on May 5.

In the meantime we went on with our researches from the aetiological point of view, and we prepared different cultures from the nasal and pharyngeal secretions of the child, the mother and grandmother; but those experiments did not reveal any bacilli diphtheriticici.
However, we heard that the midwife, who had stayed with the baby for 20 days, had had such a severe angina that she could hardly speak at all, and that in the second half of February, the mother had had a sore throat for a week, while the grandmother had complained of a bad throat for one day at about the same time.

On May 6, the right eye already showed a better aspect; the perilimbal bulbar conjunctiva was less dull and more shining; the coating that had covered it had nearly disappeared. The left eye had undergone, by far, the greater improvement; the cornea had cleared up and its ulcerated part was cicatrizing.

On May 7, a fresh injection of 5,000 units of antidiphtheritic serum was effected.

We saw the patient again on May 12. The right eye was completely healed. As to the left eye, it showed no symptoms of inflammation any longer; the cornea presented a cicatrization stain, that was white-greyish and opaque with a faint reddish hue, resultant on the presence of many blood vessels. This stain had taken the place of the old ulcer. The rest of the cornea had found its transparency again; the aqueous humour did not present any more trouble; the pupil was cleaned, though deformed, and had shifted towards the nasal side, the iris adhering to the leucoma. The eye had a normal volume and did not show, for the time being, any symptom of atrophy.

The patient had been suffering since her birth from a tenacious rhinitis, which has also been cured by serotherapy. Are we warranted, notwithstanding the negative cultures, in deciding on the diphtheritic nature of that rhinitis? We think we are.

As to the origin of that ocular diphtheria, we have only been able to retain one source of contamination—the midwife’s angina.

To conclude, let us draw the reader’s attention to the rapid and indisputable efficacy of the antidiphtheritic serotherapy.

_Case 2._—On June 5, we were brought a small boy, one month old. It had been noticed that since his birth his eyelashes had been sticking together in the morning, that some pus used to gather, during daytime in the inner canthus of the eye and that rather an acute rhinitis affected the child.

The ocular affection had been attended to by means of argyrol instillations, but without any success; all other treatments, taken against that rhinitis, had given no result whatever.

On examination we saw that the lashes of both eyelids were sticking together owing to small yellowish concretions, formed by dried pus. We had to separate them to open the eyelids. We noticed then that canary-yellow muco-purulent secretions had accumulated at the inner canthus of the eye under the shape of
FIG. 1.
Ulcer of the cornea of the left eye (Case 1).

FIG. 2.
Loeffler's bacilli (conjunctival secretion of Case 3, coloured by Gram's method).
**Fig. 3**

Loeffler's bacilli (culture on solidified ox-serum, coloured by methylene blue).

**Fig. 4.**

Baccilli diphtheritici (culture on solidified ox-serum, coloured by Ernst-Neisser's method).
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small concretions and that some muco-purulent filaments and flakes lingered in the lower fornix.

The palpebral conjunctiva was quite red; the bulbar conjunctiva only showed a few streaks of injection. On all its surface, the skin of the eyelids showed a slight and uniform erythematous colouration. The upper lids presented a very slight oedema.

The left lacrimal canal was quite permeable. On the right, by pressing on the lacrimal sac, we caused some muco-purulent secretion to ooze out through the lacrimal puncta; we could thus deduce the presence of congenital dacryocystitis. There was, on both sides, a slight preauricular adenopathy, having the volume of a small pea. We also noticed a bilateral muco-purulent coryza. The edges of both nostrils were covered with dirty, brownish scurfs, formed by dried secretion. Under the nose was an erythematous spot, due to the irritation of the skin, caused by the nasal flow.

As there existed a congenital dacryocystitis, one, of course, on account of the conjunctival inflammation, thought of a conjunctivitis of the newly-born, having a lacrimal origin.

But the conjunctival secretion, besides a few cocci, contained numerous diphtherimorph bacilli, showing a fragmentary colouration and Neisser's polar bodies. These bacilli easily grew on solidified ox-serum and gave elevated, roundish and greyish colonies. They grew with more difficulty on gelose; they did not liquefy gelatine, nor did they coagulate milk. They did not thrive on potatoes and produced acid in broth. They developed in the entirety of Veillon's gelose without spreading in the open air and fermented the glucose. They also possessed haemotoxic power.

The injection under a guinea-pig's skin of 0.5 c.c. of the broth culture, 24 hours old, produced a local, subcutaneous, gelatinous oedema, followed by an eschar, which gradually disappeared; some symptoms of toxi-infection took place; loss of weight of 40 gr., rise of temperature (up to 39°C.), prostration. However, the animal recovered completely and regained its weight within a fortnight.

As we had not kept the microbian stock, we found it impossible to repeat the operation with a guinea-pig that had been rendered immune. However, in the conjunctivitis cases, the secretion of which contained pseudo-diphtheritic bacilli, a stronger injection (1 c.c. of microbian culture) has never given us the slightest reaction, either local or general.

Besides numerous bacilli, the conjunctival secretion contained a few Gram-positive diplococci. Those cocci were easily grown on gelose, containing serum, and gave birth to a thin sowing of dot-shaped and transparent colonies. They did not liquefy gelatine.
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and did not develop on potatoes. In broth they produced a cloud, disappearing by way of sedimentation. They caused milk to coagulate rather slowly. They were dissolved by ox-gall and, when injected under the skin of a mouse, they killed the animal after 48 hours. We were thus in presence of pneumococci.

Consequently, the baby presented a catarrhal conjunctivitis, due to the diphtheria bacillus, associated with the pneumococcus.

One might have wondered whether one had witnessed a diphtheritic conjunctivitis or a pneumococccic one. Chance would have it that we were in a position to solve the enigma without any difficulty, because the twin-sister of the little patient also had a conjunctivitis, the secretion of which yielded pure cultures of Loeffler's bacilli, as pointed out in the next case. This is, of course, very strong evidence on behalf of the diphtheritic nature of the little boy's conjunctivitis.

Is it possible that the dacryocystitis could have been of the same nature? We carefully and repeatedly cleansed the conjunctival sac and, after having several times pressed out the lacrimal sac, we sowed part of the secretion, that we contrived to take up by means of a probe from inside the lacrimal sac. The culture did not give us anything but pneumococci.

Was the rhinitis also of a diphtheritic nature? Very likely so, although the cultures of the nasal and pharyngeal secretions only revealed micrococci.

We could not get any information enabling us to discern the origin of the diphtheritic infection. The cultures that we effected with the pharyngeal secretions of the father and mother and of a relative, who had frequently been in close touch with the child, only showed common micrococci. We noted no angina case either in the family or in the persons about the child.

The treatment consisted in a subcutaneous injection of 5,000 units antipneumococcal serum, effected twice in consecutive days. The result of this therapy proved excellent, when all previous treatments had given no improvement whatever; on June 9, the conjunctivitis was quite cured and the rhinitis was much improved already; but the dacryocystitis still persisted. We then effected a catheterisation of the lacrimal canal and, three days later, everything was in perfect order.

Case 3.—Together with the above mentioned little boy, his twin sister was brought to us. Since her birth, a purulent secretion, that soiled her eyes and flowed through her nostrils, had been observed. Treatment of the ocular inflammation and the rhinitis, had given no improvement.

On examining the child, we noticed that the lashes of both eyes were agglutinated by dirty yellow concretions, formed by dried
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pus. On opening the eyelids, we saw that yellowish muco-pus had gathered in the inner canthus and that muco-purulent filaments and flakes were lingering in the lower fornix. The palpebral conjunctiva, as well as the fornix, were much congested. On the level of the bulbar conjunctiva, the hyperaemia was much less evident. The palpebral skin was slightly erythematous and the upper lids presented a slight oedema.

There was, on both sides, a slight preauricular adenopathy, having the volume of a small pea. The lacrimal canal was quite permeable.

We noted a bilateral rhinitis, which was characterized by a muco-purulent flow and by dried secretion under the form of brownish dirty scurfs, sticking to the edge of the nostrils; the latter showed a few small fissures.

The conjunctival secretion contained diphtherimorph bacilli (Fig. 2), which we have detected in the different cultures free from any other germs (Fig. 3).

These bacilli were morphologically similar to Loeffler’s; they also fixed the colouring matter irregularly and carried Neisser’s bodies (Fig. 4). On solidified serum they produced greyish, dot-shaped colonies, the surface of which was convex and whose edges were roundish. They developed less quickly on gelose and gave small, flat, opaque and white colonies, the edges of which were quite irregular. They did not liquefy gelatine. did not develop on potatoes and did not coagulate milk. In broth they produced a cloud of the fluid, small clots along the inner surface of the tube and a film at the top of the fluid; at the same time they produced acid.

They developed in anaerobiosis without spreading in the open air. They caused glucose to ferment and had haemolytic properties.

Under the skin of a guinea-pig, weighing 320 gr., we injected 0.5 c.c. of broth culture, 24 hours old. At the place of injection sprung a subcutaneous and viscous oedema, which was followed by an eschar, that subsequently disappeared. A few symptoms of toxification took place; progressive loss of weight of 60 gr., rise of temperature (up to 39.3°C.) prostration. However, the animal recovered and recuperated its initial weight after three weeks.

The catarrhal conjunctivitis affecting the child was consequently due to an unaccompanied Loeffler’s bacillus.

Was the rhinitis also of a diphtheritic nature? One would feel inclined to think so, were it not for the fact that the cultures of the nasal and pharyngeal secretions showed nothing but common micrococci.

We did not set up any local treatment, but twice effected subcutaneous injections of 5,000 units antidiphtheritic serum in
consecutive days and obtained, on the third day, a complete cure of
the conjunctivitis, as well as an important improvement of the
rhinitis, whilst the ordinary methods had had no influence. The
rhinitis itself was totally cured on the fifth day.

Case 4.—On November 19, we were brought a little girl, aged
two months. Since her birth the lashes of her left eye were
agglutinated in the morning, and in the daytime a yellowish
secretion soiled the same eye. The right eye had never shown
any disorder, except a fortnight previously, when there was—
but only for one day—some pus in it.

Moreover, for 10 days, the child had been suffering from a
coryza, which was so violent that she could hardly feed.

On her birth the midwife instilled silver nitrate and against the
inflammation of the left eye several treatments were used without
any result.

The right eye was absolutely normal. As to the left eye, it
showed a perfectly characteristic catarrhal conjunctivitis; the lashes
were sticking into brushes and small dirty and brownish con-
cretions adhered to them. A yellowish muco-pus had gathered
in the inner canthus; muco-purulent filaments and flakes were
lingering in the lower fornix. The palpebral conjunctiva, as well
as that of the fornix showed a well marked hyperaemia. The bulbar
conjunctiva showed a few injection streaks.

A rhinitis with bilateral muco-purulent flow existed; a few dried
secretions under the shape of brownish scurfs, covered the edges
of the nostrils, that were obstructed by them. The subnostril skin
was red and inflamed.

Owing to these symptoms, one would feel inclined to determine
the diagnosis of lacrimal conjunctivitis neonatorum; but the
lacrimal canal was perfectly permeable.

The conjunctival secretion contained a quantity of diphtheri-
morph bacilli, as well as a few cocci. Those bacilli were Loeffler’s.
They presented an irregular colouration and carried Neisser’s
bodies. They were easily grown in broth and on coagulated serum
but with much more difficulty, on gelose. They did not coagulate
milk, did not liquefy gelatine, and did not grow on potatoes.
They thrive in anaerobiose, caused glucose to ferment and pro-
duced acid in broth. But they were not possessed of any haemolytic
power.

When injected under the skin of a guinea-pig, weighing 315 gr.,
0·5 c.c. of the broth culture, 24 hours old, produced, at the point
of injection, a subcutaneous and viscous oedema, which
was followed by an eschar, that disappeared after a time. The guinea-
pig presented some symptoms of toxi-infection; prostration, pro-
gressive loss of weight (up to 55gr.), rise of temperature (up to
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39°C.2). The animal recovered completely after three weeks, having nearly recuperated the whole of its initial weight.

The same microbian injection having been applied to a guinea-pig, that had previously been rendered immune by an injection of antidiphtheritic serum, was followed by no phenomena, either local or general.

The cocci were pneumococci; they were Gram-positive diplococci; they grew better on gelose-serum, whereon they produced transparent and dot-shaped colonies. They did not liquefy gelatine and did not develop on potatoes. They coagulated milk at the end of six days. In broth they caused a slight cloud, that disappeared by way of sedimentation. Ox-gall caused their dissolution and a 1 c.c. injection of microbian emulsion caused the death of a mouse in 48 hours.

The culture of the nasal and pharyngeal exudation of the child showed common micrococci.

Consequently, the baby had caught a unilateral diphtheritic conjunctivitis of a catarrhal type.

Case 5.—On March 5, we were brought a young boy, aged one month. About a week after the child’s birth, a conjunctivitis declared itself and remained stationary, notwithstanding argyrol instillations. At the same time, a rhinitis, that was dealt with without any success by means of eucalyptol, began to affect the baby.

The examination of the eyes proved the existence of a catarrhal conjunctivitis; the lashes were sticking into brushes by a yellowish and muco-purulent secretion; some lashes were covered with small brownish and dirty concretions. Some dirty yellow muco-pus, under the shape of a biggish clot, had accumulated in the inner canthus of the eye. When we everted the lower fornix, we found muco-purulent filaments in it.

The palpebral conjunctiva and that of the fornix was obviously congested. On the bulbar conjunctiva we saw some distended vessels in the form of radial streaks. The skin of the lids presented a diffuse erythematous colouration that was accentuated near the free edges.

On either side there was a small preauricular adenopathy having the volume of a small pea. It was hardly visible, but easily discernable under the pressure of a finger.
We also noticed rhinitis; there was rather an abundant bilateral nasal muco-purulent flow; breathing through the nose was noisy and difficult; the free edge of the nostrils was covered with brownish and dirty scurf.s. Under the nostrils the skin was erythematous and showed a crescent-shaped erosion.

The microscopic examination of the conjunctival secretion showed a number of diphtherimorph bacilli and a few cocci. Cultures on solidified serum gave two kinds of colonies: white-greyish, opaque, dot-shaped colonies, which were the more numerous and contained diphtherimorph bacilli; and three bigger colonies, 1 mm. diameter, China-white and containing cocci.

The diphtherimorph bacilli were Loeffler's; they fixed the colouring matter in a fragmentary way and were carrying polar bodies. They grew easily on solidified ox-serum, but with more difficulty on gelose. They did not liquefy gelatine, did not grow on potatoes and did not coagulate milk. They produced a cloud and acidity in broth. They developed in anaerobiose and caused glucose to ferment. They had haemotoxic properties.

Under the skin of a guinea-pig of 365 gr., we injected 0.5 c.c. of the broth culture, 24 hours old. A viscous oedema was rapidly produced at the point of injection; temperature rose to 39.60°C.; the animal became motionless, oppressed, dyspnoeic and died at the end of six days. The post-mortem examination enabled us to establish, besides the subcutaneous, gelatinous oedema at the point of injection, the presence of marked congestion of the viscera, principally of the suprarenal capsules; the ganglions were hypertrophied and an abundant effusion existed in the pleura and pericardium.

The inoculation of the same microbian culture, applied to a guinea-pig, that had previously been rendered immune by means of an injection of antidiptheritic serum, was not followed by any local or general reaction.

The cocci were white staphylococci. They were Gram-positive, spherical and grouped into clusters. On gelose, they gave a few roundish, opaque, damp, slightly granular and China-white colonies. They liquefy gelatine. In broth and milk they developed a special sour odour. An 0.5 c.c. injection under the skin of a rabbit caused an abscess that healed after having burst externally.

The catarrhal conjunctivitis of the child was consequently due to Loeffler's bacillus, associated with the white staphylococcus.

The rhinitis was also of a diptheritic nature, as we had, on the level of the nose, found a diphtherimorph bacillus, the cultural and morphologic characters, as well as the biochemical and virulence of which caused it to be identified with Loeffler's bacillus.

The cultures of the pharyngeal exudation of the child gave only common micrococci.
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It is to be noted that a brother, aged 4 years, had a pseudo-membranous diphtheritic angina, when the conjunctivitis of the baby began.

In this case we injected antidiphtheritic serum without any local treatment. On March 7, an injection of 5,000 units was effected and repeated on March 8. On March 9, both conjunctivitis and rhinitis were quite cured.

Symptoms

Catarrhal diphtheritic conjunctivitis is principally found in newly-born children and usually begins in the first days that follow birth. In four of our cases, the affection began within a week; in the first case, the original date is more difficult to determine.

In most cases it is bilateral, but may be unilateral, as was the case in our fourth observation. The second eye may be attacked rather rapidly; in three of our cases, both eyes were attacked at the time of our first examination. It is also apt to be attacked much later; in our first case, the conjunctivitis of the right eye seems to have begun six weeks after that of the left eye.

The objective symptoms of catarrhal diphtheritic conjunctivitis are:

1. **Muco-purulent secretion.**—A canary-yellow muco-purulent secretion, which is sometimes merely glairy and filamentous, is the principal sign. It agglutinates the eyelashes during the night and in the morning a moderate effort is necessary to open the lids, the lashes of which stick together, and near whose roots small yellowish concretions are to be seen. In the daytime, the lashes are sticking into brushes and the conjunctival secretion collects in the inner canthus under the form of a small and often vivid yellow clot. When evertting the lower fornix, one always observes a few yellowish muco-purulent filaments and flakes. This secretion is rapidly replaced and a short time after the cleansing of the conjunctival sac fresh muco-purulent concretions reappear therein.

2. **Conjunctival hyperaemia.**—The bulbar conjunctiva is slightly blood-shot, red streaked and more lubricated than usual, which gives the eye rather a watery aspect. The palpebral conjunctiva and that of the fornix is rather strongly congested; it may be swollen and have a granular aspect, as in one of Sourdille's cases; no follicular productions are ever found in it.

3. **Palpebral erythema.**—To the conjunctival phenomena, we must, in the very first instance, add some palpebral symptoms; one may observe a diffuse erythematous colouration that spreads over all the cutaneous region of the lids; sometimes it is more
acute on the side of the free edge. One may also notice rather a discrete oedema of the upper lid and even of the lower one.

4. *Preauricular adenopathy.*—There often exists a preauricular adenitis of the volume of a small pea. One may feel it rolling under one's finger, as observed in four of our cases.

5. *Rhinitis.*—Catarrhal diphtheritic conjunctivitis often goes on a par with rather an accentuated rhinitis, that inconveniences the nursling even to the extent of preventing it from feeding normally. We have observed this rhinitis in every one of our cases; it is characterized by a muco-purulent nasal flow of variable importance, by a stoppage in the nose, by brownish scurfs of dried secretion, which cover the edges of the nostrils and may even obstruct the same. This rhinitis causes an irritation of the free edge of the nostrils and of the subnostril region. This irritation shows itself under the form of erythematous spots, fissures and erosions.

At times, catarrhal diphtheritic conjunctivitis has an aspect of xerosis, as observed in our first case.

Between the pure catarrhal form of diphtheritic conjunctivitis, as just described, and its more characteristic pseudo-membranous form, there are intermediate clinical aspects; such is Sourdille's case, in which, besides some symptoms of muco-purulent conjunctivitis, there was a very small pseudo-membrane overlapping the fornix in the centre of the lower palpebral conjunctiva.

**Diagnosis**

Catarrhal diphtheritic conjunctivitis is none too characteristic. It has no pathognomonic signs and its symptoms are to be met with in many a conjunctivitis of another nature. However, the following observations ought to put us on our guard.

1. *Inefficacy of the ordinary treatment.*—Catarrhal diphtheritic conjunctivitis shows little natural tendency to healing; it has a chronic evolution and resists the usual treatment by means of instillations and ointments. We have been able to verify the fact in all our observations. This is in accordance with Ginestous' opinion concerning two cases he studied.

2. *Efficacy of antidiphtheritic serum.*—The antidiphtheritic serotherapy gives a rapid and complete cure. In all our cases two injections of 5,000 units of antitoxic serum have given a perfect cure within a few days (usually three to four).

3. *Coexistence of a rhinitis.*—Catarrhal diphtheritic conjunctivitis nearly always goes on a par with a persistent rhinitis, which resists all treatment but antitoxic serotherapy. Besides, Morfan and Chevalley have proved that there exists a pseudo-membraneless nasal diphtheria, which, in most cases, affects newly-born
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children and is even the most usual form of diphtheria at that age; it is a common coryza irritating the free edge of the nostrils and the subnostril region. The coexistence of this fissure characterized coryza must, according to Grenet's opinion, cause us to think of a conjunctivitis of a diphtheritic nature.

4. Presence of a preauricular adenitis.—The fact is of importance in the diagnosis of a diphtheritic conjunctivitis with catarrhal form; it is almost constant in this case, whilst it is only exceptional with certain common conjunctivitis such as pneumococcic or Morax-Axenfeld conjunctivitis.

5. Commemoratives.—The study of commemoratives is apt to furnish us with valuable information. For instance, in one of Sourdille's cases a woman contracted a diphtheritic catarrhal conjunctivitis from her children, who were also suffering from a pseudo-membranous diphtheritic conjunctivitis. In our first case, the midwife, who had lived for 20 days near the child, had also had a marked angina; both the mother and the grandmother had complained of a slight sore throat. In our last case, the child's brother had contracted a pseudo-membranous diphtheritic angina. All our nurslings originated from a district where diphtheria exists in an endemic state and where a recrudescence of epidemic was noted at the time of our studying the above mentioned conjunctivitis.

Complications

As the pseudo-membranous form, so the catarrhal form of ocular diphtheria may be complicated with corneal lesions, as observed in our first case.

Aetiology

Catarrhal diphtheritic conjunctivitis is due to the pullulation of Klebs-Loeffler's bacillus in the conjunctival sac.

1. Age.—While it is apt to be found at any stage of life, even in adults; as in Guilbert's and Sourdille's cases, it is nearly always noticed to attack newly-born babies or nurslings. Our own five observations, Chartres' three and Ginestous' two are the proof of what we do not hesitate to assert.

2. Epidemicity and contagion.—Catarrhal diphtheritic conjunctivitis is only met with in a sporadic state. All our patients came from a locality where diphtheria exists in an endemic state and where there was a recrudescence of the epidemic at the time of the outbreak of their conjunctivitis. We have only found two cases in the same family (cases 2 and 3).

Twice only have we been able to establish the origin of our nursling's contamination (cases 1 and 5); it was a diphtheritic
angina, probably in the former case, but certainly in the latter. In Sourdille’s case, the patient had been contaminated by her children, who had caught a pseudo-membranous diphtheritic conjunctivitis.

3. Is catarrhal diphtheritic conjunctivitis a primitive or a secondary diphtheritic localization?—It may be primitive. But it often follows a nasal diphtheria, the infection growing gradually through the lacrimal canal; it seems that such was the case with our patients; the fact that it was impossible to find Loeffler’s bacillus in the nasal secretions cannot be evidence against this theory, as it is not always possible to isolate the diphtheria bacillus; on the other hand, the quick healing of our nurslings’ rhinitis overcome with serotherapy, constitutes an argument on behalf of the diphtheritic nature of their coryza.

4. Is catarrhal diphtheritic conjunctivitis a primitive or additional infection?—It may be primitive; our third observation proves it, because Loeffler’s bacillus was existing alone.

It may also be an additional infection; in our second observation, the pneumococcic congenital dacryocystitis, which was probably primitive, has enhanced the further infection by the diphtheria bacillus.

5. Can Loeffler’s bacillus grow alone in the conjunctival sac?—We do not hesitate to answer in the affirmative; our third case is a proof thereof. Besides, Trapezontzewa has effected the same observation three times out of 11 cases of diphtheritic conjunctivitis. However, those facts rather constitute an exception. Morax even believes that they do not exist.

6. Loeffler’s bacillus is generally associated with other microorganisms.—We have once found it associated with white staphylococcus and three times with pneumococcus. Those microbes may remain harmless or add their pathogenic action to that of the diphtheria bacilli. It seems that in our cases, the associated microbes were really pathogenic, for, if they grew less abundantly than the diphtheria bacillus, they were not less virulent for experimental animals. Most probably it is owing to the pneumococcic association that we may account for the serious evolution of our first patient’s corneal ulcer.

7. Why does Loeffler’s bacillus sometimes cause only a catarrhal conjunctivitis, when it more often gives birth to a pseudo-membranous conjunctivitis?—This fact seems, on one hand, to be dependent on an attenuation of the virulence of the diphtheria bacillus, and on the other hand, on the nature of the microbe that is associated to it.

(a) In the muco-purulent conjunctivitis that we have observed, the virulence of Loeffler’s bacillus was attenuated; its pathogenic action for the guinea-pig had, indeed, sensibly diminished and
was, in three cases, hardly evident; besides, that observation was in accordance with the fact that the observed diphtheria bacillus belonged to the middle kind, which according to Martin and Sourdille, is less virulent than the long sort.

Now since the experiments of Coppez, Morax and Elmassian, Roger and Bayeux, it is known that the pseudo-membranes are due much more to the toxin secreted by the diphtheria bacilli, than to the bacilli themselves. Consequently, we think that it is to the attenuation of the bacilli’s virulence, and subsequently to a lesser production of toxins, that the absence of pseudo-membranes in our cases and their evolution under the shape of catarrhal conjunctivitis should be attributed.

(b) The association of pneumococci or staphylococci with Loeffler’s bacilli seems to give the conjunctivitis a more benign physiognomy than the association of other micro-organisms, streptococci, for instance. Sourdille had already observed that the pseudo-membranous form itself was considerably less serious, when the diphtheria bacillus was accompanied by staphylococci than when it was associated with streptococci.

**Prognosis**

The prognosis of catarrhal diphtheritic conjunctivitis depends upon the precocity of the diagnosis and of the serotherapy. When carelessly attended to, it becomes chronic, lingers and may acquire corneal complications that are sometimes quite serious (case 1). On the contrary, under the influence of antitoxic serum, it heals very quickly and, for our first patient, we may wonder whether adequate treatment could not have prevented the corneal ulcer, should we have been able to establish the aetiological diagnosis of the ocular affection sooner.

**Treatment**

No local treatment is to be instituted. Antidiphtheritic serotherapy is sufficient; as early as the day after the first injection of antitoxic serum, the conjunctival secretion dries up and a complete healing happens on the third or fourth day.

Twice in two days running we injected 5,000 units of antidiphtheritic serum under the skin. From our experience, this quantity should be sufficient, even when the case is complicated with corneal lesions. However, should the improvement not be manifest after the second injection, there is nothing to prevent us from effecting a third and even a fourth injection. Nevertheless, we think it useless to resort to bigger doses, the quantity of toxin absorbed being probably rather small.
The eventual corneal complications are treated, together with the causal general condition, by means of antiseptic bandages, and either mydriatics or miotics, according to circumstances.

Discussion

When perusing the ophthalmological literature, we observe that several authors have written about catarrhal diphtheritic conjunctivitis without having gone thoroughly into the subject.

As early as 1893, Guilbert conjectured the possibility of a catarrhal form of diphtheritic conjunctivitis when studying a case of chronic pseudo-membranous conjunctivitis "that was affecting a girl, aged 7 years, who, since the age of 3 months, had always had skins and pus in the left eye and whose right eye had been infected in December, 1892. At intervals, the pseudo-membranes disappeared, but even then a purulent secretion subsisted."

The first observation of catarrhal diphtheritic conjunctivitis is due to Sourdille in 1894. Mme. V. was the mother of a child, aged 4 years, who presented a serious interstitial diphtheritic conjunctivitis with corneal complications, perforation of the cornea and subsequent phthisis bulbi. Another of her children, a girl, aged 2 years 6 months, had also shown a serious interstitial diphtheritic conjunctivitis, complicated by corneal lesions of the right eye. She came to the doctors on July 17. For four to five days her left eye had been slightly sore; it was then red and watery; the lids were hardly swollen. The conjunctiva of the lower lid was swollen, granular and red; in its centre and overlapping the fornix was a small pseudo-membrane, which disappeared two days later. For the rest, there simply existed a filamentous, glairy secretion, out of which it was possible to isolate a virulent diphtheria bacillus.

Uhthoff, von Hippel, Pichler, Chartres, Coppez, Ginestous and von Herrenschwand have reported similar facts.

In a conjunctival inflammation, Uhthoff has been able to isolate a virulent diphtheria bacillus, whilst there was no sign of any pseudo-membranes.

Pichler has inspected the eyes of certain children who were accompanying to the doctors their brother and sister who were suffering from pseudo-membranous conjunctivitis; these children either had sound eyes, or complained only of a slight burning sensation. Every time Pichler found moderately virulent Loeffler's bacilli in the conjunctival sac, but he could not obtain more than three to five colonies per plate. These diphtheria bacilli disappeared rather quickly after the recovery of the other members of the family.

E. Chartres has found the diphtheria bacillus alone in three cases of ophthalmia neonatorum.
Catarrhal Diphtheritic Conjunctivitis

H. Coppez writes that if Loeffler's bacillus can produce a superficial or interstitial pseudo-membranous conjunctivitis, it can also cause a mere catarrhal conjunctivitis.

E. Ginestous has observed two cases of ophthalmia neonatorum affecting a merely purulent form, without any pseudo-membranes, but undergoing an abnormal evolution and refractory to the usual treatment and silver instillations. The bacteriological examination of the conjunctival secretion proved that it was a question of middle and long bacilli diphtheritic conjunctivitis, and that the antitoxic serotherapy produced a rapid cure.

von Herrenschwand writes that Loeffler's bacillus can cause simple catarrhal conjunctivitis without any pseudo-membranes, which are distinguished with difficulty from other muco-purulent conjunctivitis due to another microbial cause.

Pes says that when examining 75 cases of acute conjunctivitis he found Loeffler's bacillus 20 times, either alone, or associated with Weeks' bacillus. These assertions should only be accepted reservedly, for a confusion with the xerosis bacillus may have taken place, the more so as the identification proceedings have been insufficient. Besides, Kuschbert-Neisser's bacillus quite often accompanies Weeks' bacillus and grows so easily in the cultures of the latter, that it is quite apt to screen the real pathogenic agent; that is the reason why Morax has only been able to obtain pure cultures of Weeks' bacillus after many attempts.

V. Morax thinks that the facts, which advocate on behalf of the existence of a catarrhal conjunctivitis of a diphtheritic nature, are not sufficient. He raises the following objections:

1. Virulent diphtheria bacilli are sometimes found on the conjunctiva, even in the absence of inflammatory phenomena. Certain germs, like pneumococci and staphylococci, can live as simple saprophytes in the conjunctival sac and can, at a given moment, resume their pathogenic action to cause a muco-purulent conjunctivitis and even a pseudo-membranous one. Why, then, would it be surprising that Loeffler's bacilli might occasionally be a harmless guest of the conjunctiva, and at other times cause a conjunctivitis, which, according to circumstances, will be catarrhal or pseudo-membranous?

2. The diphtheritic process rarely evolves in a pure state; most commonly, it goes on a par with another infection, which is much more contagious, and plays the part of bait. We are consequently entitled to wonder whether the fact that the pseudo-membranes have not developed, is not the sign of a lack of proliferation of the diphtheria bacilli, which, however, may exist in units on the conjunctiva. To this objection, we may answer:

(a) There are cases of catarrhal diphtheritic conjunctivitis in which Loeffler's bacillus is in a pure state (our case 3 and Chartres' cases).
(b) Certain cases of conjunctivitis, even those in which the diphtheria bacillus is associated with other germs, are complicated with corneal lesions, which can only be accounted for through the intervention of Loeffler's bacillus (case 1).

(c) Loeffler's bacillus, found on our patients, was virulent, as was the case with Sourdille's and Uhthoff's bacilli.

(d) Catarrhal diphtheritic conjunctivitis is refractory to the ordinary medical cure, but on the contrary, rapidly disappears by means of the antitoxic serotherapy, which does not possess the same favourable action on the muco-purulent conjunctivitis of another nature.

3. It may also be supposed that the small quantity of toxin, secreted by the diphtheria bacillus, has not been sufficient to determine the production of a pseudo-membrane.

This suggestion is by no means an objection to the existence of a catarrhal diphtheritic conjunctivitis; on the contrary, it seems that it is the very explanation of its possibility; we have, indeed, shown that the diphtheria bacilli, under review in our cases, presented a diminished virulence.

Besides, the existence of a catarrhal form of diphtheritic conjunctivitis must not surprise us, as the studies of Koplich, Goldscheider, Feer, Aviragnet, Le Soudier, and others, have shown us that there are pseudo-membraneless diphtheritic anginas and even simple erythematous ones.

There are also pseudo-membraneless nasal diphtherias, manifesting themselves under the form of a muco-purulent coryza, as Hutinel's, Grenet's and Lesné's, Marfan's and Chevalley's studies have ascertained.

Conclusions

1. Besides the pseudo-membranous forms of diphtheritic conjunctivitis, there is a mere catarrhal form.

2. The latter is often met with in newly-born children and should be ranked among the ophthalmias neonatorum.

3. It shows no pathognomonic sign and has the aspect of nearly all muco-purulent conjunctivitis.

4. Because of its clinical aspect, it seems to be the most benign of all diphtheritic conjunctivitis; however, it may be complicated with serious corneal lesions.

5. It is refractory to the ordinary treatment, but it heals completely and rapidly under the influence of antidiphtheritic serotherapy.
DISTURBANCES OF THE VISUAL APPARATUS

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DISTURBANCES OF THE VISUAL APPARATUS IN THE TOXAEMIAS OF PREGNANCY ASSOCIATED WITH ECLAMPSIA OR THE PRE-ECLAMPTIC STATE

BY

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In November, 1933, the first-named writer saw in consultation with Dr. Narayanaswami Pillai of the above hospital a case of "blindness following eclampsia." "A" was a Hindu, aged 18 years; 18 months before she was nearing full term as a primipara. She had been a big strong healthy girl and never suspected anything wrong till she got fits near the time of her delivery. They were not bad and she consulted Colonel Hingston, at that time Superintendent, Madras Government Hospital for Women and Children. He
CATARRHAL
DIPHTHERITIC
CONJUNCTIVITIS

J. Francois

doi: 10.1136/bjo.19.1.1

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