AGRICULTURAL CONJUNCTIVITIS.

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The six cases here reported are sufficiently alike to constitute a clinical group. All the patients were adult or adolescent males engaged in outdoor occupations, which suggested the name proposed. Bacteriologic investigations showed mixed infection in all. A large gram positive anaerobic bacillus found in 5 of them is possibly an etiologic factor. They were characterized by enormous swelling of the lids, swelling of the adjoining lymph nodes, superficial necrosis of the skin of the lids and pseudomembranous deposit on the conjunctiva. The cases were studied in the Department of Ophthalmology, University of Nebraska, College of Medicine. The paper was presented to the Section on Ophthalmology of the American Medical Association, June, 1921, and is published here thru the courtesy of the Journal of the A. M. A.

During the last year, we have seen six cases of a type of conjunctivitis, unique in our experience, which presented enough clinical features in common to justify their presentation in a group, with the idea of determining whether or not they form a distinct clinical entity.

REPORT OF CASES

CASE 1.—History.—W. G., a farmer, aged 17, first seen May 23, 1920. About five days before, he had noticed a swelling of the cervical glands on the right side. The swelling seemed to extend upward, and a day or two later, the right eyelids began to swell rapidly: The pain was not marked, but considerable discharge was present.

Examination.—Both lids of the right eye, especially the upper were swollen to such an extent that they could be opened only a few millimeters. They were deeply congested, hard and hot. The preauricular and cervical glands were markedly enlarged and tender. The skin of the lower lid showed several grayish areas, 6 to 10 mm. in diameter, which resembled small flat pustules. On opening one of these, only a whitish caseous material was found. There was a similar area on the skin about each canthus, which remained excoriated and bleeding for some days, and the skin of the lid border was covered with a closely adherent membrane. The palpebral conjunctiva, where it could be seen, was covered with a similar thick membrane. The bulbar conjunctiva was thickened and congested but showed no membrane. The temperature on admission was 101.4 F., 99.8 the following day, and on subsequent days reached 99 almost every day, until a few days before dismissal. In spite of this, the leucocyte count was only 8,000.

Clinical Course.—Under frequent hot applications and instillations of argyrol, the swelling of the lids and glands gradually subsided. The membrane slowly disappeared and the pustules, after the superficial layers had sloughed off, healed up, leaving slight scarring. Zinc oxid was kept constantly applied to the skin of the lids under a loose dressing. One week after admission, a small erosion appeared near the center of the right cornea which persisted for same days, in spite of cauterezation with trichloracetic acid, until the area was curetted, when it healed up rather promptly.

He was dismissed after twenty days, with the right cornea showing a slight leucoma and considerable conjunctival thickening, but no membrane. A letter from his family physician, Dr. Cole, some months later, reports some thickening of the lids, slight congestion and excellent vision.

CASE 2.—History.—M. L., a farmer, aged 31, seen Sept. 16, 1920. About a week before, while working in the fields, he thought a piece of chaff had blown into his eye. His family physician had removed this, and the eye had felt fairly comfortable until about two days before he came in, when the lids of the right eye had begun to swell markedly.

Examination.—There was a hard, brawny swelling of the lids of the right eye. The lids could be separated with difficulty, scarcely sufficiently to
allow one to see the cornea. The pre-auricular and superior cervical lymph nodes were enlarged, so that the whole side of his face appeared swollen. The palpebral and bulbar conjunctiva were covered, as far as could be seen, with grayish exudate. A few small pieces of this were removed for examination. They were firmly adherent, leaving a slightly bleeding surface on removal. No foreign body was found, and as far as could be seen, the cornea was normal. A few small areas like those in Case 1, but not so extensive, were seen about the internal angle, on both lids and on the cheek below the eye. The temperature on admission was 99.4 F., and continued between 99 and 100 for about three days.

Treatment and Results.—The smears showed organisms resembling pneumococcus. In addition to instillations of zinc collyrum and 10 per cent. argyrol, 5 per cent. ethylhydrocuprein (optochin) was instilled four times a day, with frequent applications of heat and zinc oxid to the skin lesions. On the third day, one injection of 50 c.c. of polyvalent antipneumococcus serum was given intravenously. The swelling of the lids and the glands slowly subsided, so that the eye could be opened, and the membrane gradually became detached. About the tenth day, a small erosion developed on the lower inner quadrant of the cornea, which healed under atropin and heat in two or three days. When he was sent home, September 30, there was still considerable thickening of the conjunctiva but no membrane, and a localized corneal haziness which reduced his vision to 20/70.

Case 3.—History.—F. H., a farmer, aged 49, a neighbor of the patient in Case 2, seen Oct. 18, 1920. Two weeks before, while haying, he got some dust in his right eye. The eye was slightly red, and after a week, his home physician removed a small foreign body from his eye. After a day or so, he noticed a swelling of his lids, and for three days before coming in, he had been unable to open them.

Examination.—There was an enormous hard, brawny swelling of both lids of the right eye. The cornea was indistinctly seen but apparently intact. The preauricular and submaxillary glands were enlarged and hard. There was a small pustule, one-half inch below the center of the lower lid border. The lids could be opened slightly, enough to allow one to see that both lids were covered with a thick membrane coming up close to the cornea and extending out from the lid borders (Fig. 1). Small portions of the membrane were removed, but no attempt was made to find a foreign body.

Treatment and Results.—The patient was put on boracic irrigations every two hours, 5 per cent. optochin every two hours, and thirty grains of sodium salicylat, three times a day. For the first few days, the brawny swelling became even harder, so that the lids could not be opened at all. After a week, they could be opened slightly, so that the membrane was seen to extend to the limbus and slightly overlap the cornea all around. After ten days, a superficial ulceration appeared on the cornea, which eventually included most of the upper half. The patient's temperature was 99.6 F. on admission, 101.2 during the second day, and reached 100 on the four succeeding days, after which it dropped to 99 for two days and then to normal.

For personal reasons, he was obliged to go home on the thirteenth day with the swelling mostly gone, but with marked adhesions of the upper folds,
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a haze involving the upper half of the cornea and vision of hand movements at one foot. Dr. Malster, five months later, states that there is still considerable thickening of the lids and some ptosis; the conjunctiva is inflamed, with a tendency in certain parts to be granular. He also reports that the cornea is quite cloudy, the pupil is not easily outlined and there is a pseudopterygium on the inner side, running to the edge of the iris and quite congested. Also the rest of the eyeball is still quite red. Vision is hand movements.

On March 24, 1921, he returned, when the condition shown in Figure 2 was seen. There were adhesions of the lids to the globe both above and below, with a thick vascular tissue covering about three-fourths of the cornea, leaving a clear area up and out, however, thru which 3/200 vision could be obtained.

CASE 4.—History.—W. M., aged 11, a farmer's son, was referred Oct. 31, 1920. The week before, he had noticed that the right eye was a little inflamed. It remained so for two or three days, when the lids began to swell rapidly. He gave no history of trauma.

Examination.—When first seen, the skin and subcutaneous tissue of the entire upper lid was necrotic and covered with a grayish exudate, with crusting over the central portion. There were several discrete flat yellowish pustules on the side of the nose below the lower lid, and on the brow above the upper lid, from 7 to 8 mm. in diameter. There was marked swelling and redness of the tissues from the ear to the external angle, extending down nearly to the angle of the jaw (Fig. 3). No attempt was made to separate the lids, but the patient was unable to open them even slightly. His temperature was 101.2 F. on admission, reached 100 and 99.4 on two successive days, and then dropped to normal.

Treatment and Results.—He was given frequent applications of moist heat, and a moist lead lotion dressing was kept constantly applied. When his eye could be opened, he was given instillations of weak zinc collyrium and yellow mercuric oxid ointment. About the tenth day, a small superficial corneal erosion appeared on the cornea of the other eye, with only moderate congestion of the conjunctiva and no secretion or involvement of the lids. This cleared promptly on local applications. While he was under treatment, several new pustules developed on the lower lid which healed without any scarring. On dismissal, the area of superficial necrosis over the upper lid had begun to heal in considerably at the edges.

Fig. 2 (Case 3).—Appearance of eye after four months.

CASE 5.—History.—W. D., aged 16, first seen Dec. 26, 1920. A few days before he first noticed the symptoms, he had been employed in clearing up a patch of dry weeds near his home. For the last week, his right eye had been inflamed, and for three days he had been under treatment by another oculist, who had given him argyrol instillations.

Examination.—When first seen, both lids were somewhat swollen but could be opened. The palpebral conjunctiva was markedly thickened. The ocular conjunctiva was chemotic, and the eye and clean granulations covered the ulcerated portion. His vision was 20/20 with correction in each eye. No membrane was ever observed, but during the first week, it was impossible to get a view of the conjunctival surface.
could be moved only a few millimeters in any direction. The preauricular and submaxillary glands were palpable but not tender. The temperature was normal, but he stated that he had had chills and fever several times during the last few days. He was told to continue treatment with the addition of frequent applications of moist heat. He did not report the next day as directed, but on the third day presented himself with a swelling of the lids so extreme, that they could be opened only slightly. The upper lid was hard and hot. The preauricular and submaxillary glands were much more swollen and tender. There was a moderate amount of mucopurulent discharge in the sac, but no pustules on the lids or evidence of membrane (Fig. 4).

Treatment and Results.—Under frequent applications of moist heat, weak zinc and boracic instillations and atropin, the swelling of the lids decreased rather promptly, so that in a week he was able to open his eye about one-third of the normal extent. After this, there was still considerable swelling at the outer angle of the lid, and the conjunctiva remained congested and showed a peculiar follicular hypertrophy near the outer angle, which was still apparent two months later, tho the ocular conjunctiva was normal and the eye was perfectly comfortable. The cornea was never involved, and his
vision remained 20/15. The temperature during the first three days at the hospital was 99 F., after which it dropped to normal.

Case 6.—History.—D. R., aged 9, the son of a farmer, was referred to us, Jan. 12, 1921. While playing with other children, he had scratched the skin of the right upper lid with a weed. After three or four days, the lid began to become red and the redness increased for two weeks. It began to swell rapidly two days before coming in.

Examination.—There was very marked brawny swelling of the upper lid, which hung down over the lower. The skin was tense and red with a moderate purulent discharge from the sac. The preauricular glands were moderately enlarged but not particularly tender. Extending from above the inner canthus down to and including the lower lid, there were several small flat discrete lesions such as have been described in the other cases (Fig. 5). There was no attempt made to separate the lids, but a characteristic membrane protruded below the lid margin.

Treatment and Results.—This consisted of heat and irrigations. The swelling reacted promptly to treatment, so that after the fourth day, we were able to get a fairly good view of the lower portion of the cornea. Two days later, the lids had opened sufficiently, so that all of the cornea could be seen and was perfectly clear. The next day, however, on examining the cornea, the lower one-third was found to be decidedly hazy, due, evidently, to improper coaptation of the lids. This cleared up on keeping the cornea thoroughly protected with petrolatum.

The symptoms rapidly subsided and he was discharged on the fifteenth day, but returned a week later for examination, at which time, in spite of considerable thickening of the conjunctiva and photophobia, he had vision of at least 20/50. His temperature on admission was 100 F. and ranged up to 99 for ten days. A report from Dr. Zimmerman six weeks later stated that there was still a slight thickening of the upper lids, the conjunctiva was very slightly injected, and vision was practically normal. The doctor reported that he has known of no diphtheria, or of any cases suspected of being such, in the surrounding country for the last two or three years.

Clinical Summary

These cases, with the exception of Case 5, which was seen very early, and possibly Case 4, in which we were unable to turn the lids until the healing process was well advanced, presented very pronounced swelling and redness of the lids, involvement of the regional lymph nodes, the presence of more or less extensive skin lesions, and a dense and decidedly adherent false membrane involving both the palpebral and bulbar conjunctiva. There was a varying degree of superficial keratitis, which in no case went on to perforation, altho in Case 3 there was a very dense vascular scar involving nearly all of the cornea. All ran a temperature of from 99.5 to 101 F. at the start, dropping in a few days to normal. In all, the serious condition was monocular, tho one patient (Case 4) showed catarrhal conjunctivitis of the other eye. Our cases were all in males, ranging from 9 to 49 years of age, who were all engaged in some form of rural pursuit. Three patients gave a history of some slight trauma-
tism. It is interesting to note that four of our six patents were from the same general locality, and two of the patients reported by correspondence were from one other locality.

All cases yielded to heat and frequent instillations of mild collyria, and, reported cases did not give symptoms in sufficient detail to enable us to form an exact idea as to the nature of the condition. A number reported cases of acute conjunctivitis with unusual swelling of the lids but without membrane or skin lesions. Three cases except as mentioned before, healed with very little impairment of vision.

No antitoxin was given, as we were unable in any case to find evidence of B. diphtheriae, nor were we able to get a history of any exposure to this disease.

Since we had seen no similar cases reported from other districts, a questionnaire was sent to about three hundred general practitioners and oculists in the northern Missouri valley. Of sixty-four who replied, forty-six had seen no similar cases. Several of the remaining eighteen who were apparently episodes in the course of unusually severe trachoma, and one case was apparently Parinaud's conjunctivitis. Three cases, however, were of sufficient resemblance to warrant describing them in detail. One seems to be an exact counterpart of the cases we have seen.

The case reported by Drs. Caton and Starr of Concordia, Kan., was that of a farmer engaged in gathering his harvest when the infection took place. "The left eye only was involved, the upper lid being highly purple and

![Image](https://via.placeholder.com/150)

Fig. 5. (Case 6.) Appearance of eye at time of examination.
sagging over the lower. Large patches of membrane were present both on the bulbar and palpebral conjunctiva. The right eye was never involved. The cornea showed no involvement but a slight haziness, which we thought was due to pressure.” This patient did not remain for treatment, but it was subsequently learned that he recovered.

Dr. E. N. Robertson, also of Concordia, Kan., reported the case of a farmer, aged 58, who was working with horses. “He stated that four days previous to coming to our office, he woke with his left eye swollen shut, but no pain and very little discharge. He also said that he was subject to colds, and was having a cold at the time he first noticed the swelling in his eye. The day before coming to us, he had had considerable pain in the eye. Examination revealed the upper lid hard, red and swollen, so that it slightly overlapped the lower lid. It was impossible to evert the lid, but by having the patient look down and by the use of retractors, we were able to examine a good portion of the eye. There was a marked chemosis of both ocular and palpebral conjunctivae. There were several small ulcerated areas on the conjunctiva of the upper lid, more marked along the inner third. There was considerable lacrimation and slight mucopurulent discharge. The cornea was clear and free from ulceration. The vision was practically normal. The preauricular, as well as some cervical glands on the left side, were swollen. There were no pustules on the nose and cheek, but we were able to pick a membrane from and around the ulcerated areas on the upper lid.

We made a smear from one of the ulcerated spots, but it was negative. From a twenty-four hour growth on agar, we found practically a pure culture of a small, short diplobacillus. Not being prepared to work out the bacteriology carefully, we sent a specimen of this culture to the state laboratory and received a report that the growth showed Koch-Weeks bacillus. While the bacillus did look like the Koch-Weeks, still the fact that it grew so readily on agar made us doubt its identity. The only treatment we used was occasional applications of 4 per cent. silver nitrat to the accessible ulcerated areas and cold applications, while the patient used a 20 per cent. solution of argyrol. After about five weeks, the swelling all disappeared and the eye looked quite normal.”
The case which most resembles ours was reported by Dr. L. Robert Forgrave of St. Joseph, Mo., and concerned a farmer, aged 22. "The upper lid of the right eye was hard and very much swollen. There was a serous discharge which appeared slightly purulent, which later proved to be pieces of membrane. There was a distinct false membrane with pustules along the margins of both lids, extending onto the skin as far as the brow above and for probably an inch below. Those below were grouped more particularly around the external canthus. There was a decided swelling of the preauricular glands. This man gave a history of being struck in the eye with a small piece of weed. The microscopic findings were remarkable for the few germs shown, only a few staphylococci and occasional streptococci were found. I had scrapings from the pustules taken and the secretions of the eye reexamined with the same results. I did not notice the unilateral characteristics of this case, as I isolated the left eye, but it is possible there would have been no extension had I not done so. I treated this man with ice packs, permanganat irrigations, and argyrol instillations. He made a nice recovery with no unfavorable results, except the loss of the cilia on all of the upper and most of the lower lids, and some scarring of the lid margins. He was dismissed from the hospital after eighteen days."

**BACTERIOLOGIC SUMMARY.**

[The details of the laboratory findings have been published in the Transactions of the Section on Ophthalmology of the A. M. A., 1921, page 234.]

All cases showed staphylococci, usually in both membrane and pustules, and usually in smears as well as cultures. In five, this was *S. aureus*; in one, *S. albus*. Of three strains tested by animal inoculation, one proved markedly pathogenic, one slightly pathogenic, the other not at all. Two showed streptococci in large numbers. All showed slender gram-positive bacilli in moderate numbers in either membrane or pustule, which resembled *B. xerosis*, the only one strain was tested for pathogenicity. The bacilli never showed the typical polar staining of *B. diphtheriae*, but a predominance of clubbed and barred forms in culture, and in the absence of any other evidences of diphtheria or history of exposure to it, their identifica-
tion as *B. xerosis* seemed the most probable one.

One showed the organism called *Bacillus A i*, which produced a moderate conjunctivitis in one animal.

Bacilli resembling the large gram-positive spore bearer, found in such profusion in Cases 4 and 5, were found in the smears of all cases except Case 1. In Cases 3 and 6, only a few such organisms were found in smear, and may possibly have been atypical xerosis bacilli. In Case 2, however, their arrangement in chains made a distinction certain, while in Case 6, a culture was obtained similar to that in Case 5. A pure culture was obtained anaerobically in two cases. One of these strains produced a severe conjunctivitis in one guinea-pig, negative results in others. The other gave negative results in a limited number of animals. A rather meager investigation of these two strains with the serum of three cases gave negative results. Anaerobic cultures were made only in the last three cases.

Case 1 was rather summarily investigated. It is also to be regretted that at first the importance of the skin lesion did not sufficiently impress us, so that no investigation of their contents was made in Cases 2 and 3. They were thought to be staphylococcic infections of the skin due to the excoriation and pressure from the original condition, tho Dr. Harold Gifford from the first emphasized them as a distinct feature of the cases.

While such complex bacteriologic findings, not complete in all details, make any definite conclusion as to etiology impossible, we believe that *B. diphtheriae* can be ruled out; and since the cases with streptococci were not essentially different from the others, we believe these cannot have been the primary agent. The staphylococci, for reasons given before, we are inclined to consider as secondary occupants of the field. They were not found as the predominant organism in the smears.

In the case of the large gram-positive bacillus, however, record of its presence in five out of six cases seems more important, since any similar organisms are among the rarest findings in the conjunctival sac or on the lid borders. Tho animal inoculations gave no conclusive results, it is well known that animals differ in their susceptibility to organisms pathogenic for man. The serologic tests, tho negative, were not at all comprehensive. Hence, tho it cannot be concluded that it was the...
etiological factor, its presence in these cases seems the most interesting point in our laboratory findings. The possibility of its spores, living and viable at outdoor temperatures, having got into the eyes from vegetation or dirt and having germinated there, seems not so very unlikely.

REVIEW OF THE LITERATURE

In searching for cases similar to those we have observed, it is difficult to be sure that all reports which may have concerned such cases have been examined. Taking the four most striking features which have marked our cases, enormous swelling of the lids, swelling of the lymph nodes, ulcers of the skin of the lids, and membrane on the conjunctiva, we have sought out available reports on membranous, pseudomembranous or diphtheritic conjunctivitis, gangrene of the lids, and some of the reports of Pari- naud's conjunctivitis.

Coppez\(^1\) in an exhaustive monograph, considers most of the reported cases of membranous conjunctivitis up to 1897. He includes all types with membranous formation, and from his work, the deduction seems unavoidable that no sharp distinction, either clinical or etiologic, can be drawn between the mild or superficial and the deep or interstitial forms. All gradations are observed between them, and while *B. diphtheriae* is the commonest cause, various organisms may cause either type. He quotes several cases to show that *B. diphtheriae* may cause a simple catarrhal conjunctivitis without membrane formation, while even these catarrhal cases may present all the toxic complications of the deep form, paralysis, and even death. Sourdille\(^2\) was able to produce all of these stages in animals by graded applications of chemical agents as well as by *B. diphtheriae*. If we accept this, we escape the confusion in terminology between membranous and pseudomembranous conjunctivitis which has befogged our conceptions of this disease.

In relation to the present cases, Coppez' description of the deep form, most often due to *B. diphtheriae*, the sometimes to other organisms, is worth repeating. After a period of from one to two days, in which only a peculiar shiny appearance of the conjunctiva is noted, the period of fibrinous infiltration sets in. The upper lid becomes tensely swollen, dark with congestion, and so hard as not to be everted without an anesthetic. The membrane covering the palpebral and often the bulbar conjunctiva is thick, and detachable only in shreds.

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\(^1\) Coppez

\(^2\) Sourdille

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![Fig. 9 (Case 5).—Culture on anaerobic serum slants.](image-url)
leaving a pale subconjunctival tissue which does not bleed. The skin of the lids and sometimes of the forehead, cheeks and nose presents ulcers covered with grayish exudate. The ciliary border is ulcerated and bleeding. The preauricular and cervical glands may be enlarged. This is followed by a period of suppuration, when the lids become soft, and then by one of cicatrization, in which granulations like those in trachoma appear and may last for months, before the conjunctiva becomes smooth and scarred. Of his own fifteen cases, all but four showed skin lesions, tho in several of these, they may have been due to preexisting eczema or impetigo. All were due to *B. diphtheriae* except two, probably due to streptococci. While the clinical picture resembles very closely our cases, it must be noted that all of his cases were in children, the oldest being 6 years old, and most infants under 2 years. Moreover, all but two were binocular, while in two others a catarhal conjunctivitis only occurred in the second eye. He illustrates from the literature the occasional occurrence of a membrane in gonorrheal, Koch-Weeks, and pneumococcic conjunctivitis, but none of these cases showed skin lesions. Of the sixteen cases quoted which were due to streptococci, only his own two cases apparently showed skin lesions. In the first, a boy 3 years, an ulceration at one internal angle spread all over the lower lid. Both corneas were lost. In the second, a girl of 9 months, ulcers appeared on both left lids, the right eye showing only catarhal conjunctivitis. Both children died of pneumonia, and both strains of streptococci proved very virulent for animals. The cases apparently due to staphylococci were milder, but one of Pichler's cases, a girl of 2, showed eczematous lesions of the face, and the girl of 6 months, whose case was reported by Van der Straeten, had a severe type with perforation of the cornea, and showed also impetiginous lesions of the face. In both of these, however, the skin lesions were probably preexisting.

Of the textbooks, Axenfeld describes necrotic areas on the skin of the lids covered by membrane, as of frequent occurrence, and mentions cases in which a whole lid has become gangrenous.

Ball states that any areas of skin over which the secretion accumulates may become abraded and covered by membrane. Harman, considering seven cases of the deep form in his observation, describes "the marked ex-
coriation and necrosis of the skin, to so severe an extent in one case as to present the clinical picture of noma." He gives illustrations of this case and one other with patches of membrane on both lids. (These, with Axenfeld's, are the only illustrations we have seen showing the skin lesions.) His cases were all in very young children, and all but one were monocular, in which last point his experience differs from that of most observers. All were due to *B. diphtheriae*, except one severe case in a 2 year old child, with marked skin lesions, due to *Streptococcus brevis*. De Wecker\(^6\) states that it often extends to the skin of the lids, occasionally even producing symblepharon. Von Graefe\(^7\) mentions the extension of the membrane to the skin near the lid borders, forming discrete plaques.

Meyerhof\(^8\) describes two cases of the very severe, deep form, due to streptococci; and in both of these impetiginous or herpetic lesions were present on the skin of the lids. Both were children under 6. He describes another case in a girl of 3, in which streptococcus, Koch-Weeks bacillus, pneumococcus, and staphylococcus were present, with similar skin lesions. All three cases presented swelling of the glands. In his case due to *B. diphtheriae*, he has often seen the membrane extend into the skin of the lids, and states that symblepharon may occur.

The eczematous conditions of the lids mentioned as common by Schmidt-Rimpler\(^9\) and described as an occasional accompaniment of the condition by others, is probably of a different nature, simply the scrofulous lesions often seen in undernourished children.

Of Jessop's\(^10\) thirteen cases, one girl of 2 1/2 years showed a tremendous boardlike swelling of the right lids, with membrane extending onto the skin of both lids. This disease remained monocular, and the cornea was spared. *S. aureus* alone was found, but antitoxin was given. In Manz\(^11\) case, that of a girl of 3, swelling of the lids was so great that a canthotomy was performed, the wound becoming covered with membrane.

Hudson and Panton\(^12\) describe a monocular case in a boy of 16 with infec-

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tho not producing a membrane in animals. The meningococcus has occasionally been found, as by Ananygros and Moisonnier, quoted by Guglianetti.16

Many cases have shown mixed infections, like our cases, and Sourdille17 has emphasized the importance of the secondary organisms. He believes the cases in which the staphylococcus is associated with *B. diphtheriae* are usually of the superficial type, those with streptococcus and *B. diphtheriae* usually of the deep type, with corneal involvement. Howe18 also emphasizes the importance of the diplostreptococcus which he found with *B. diphtheriae* in his chronic cases.

Gangrene of the lids, of a type deeper than in most of the previous cases, has been reported as a complication of diphtheritic conjunctivitis. Both Axenfeld and Harman mention it, as stated above. Schillinger’s19 case, in a 14 day old infant, was considered diphtheritic, tho the organisms were identified by smear only. Vix’20 case of spontaneous symmetric gangrene of the lids and of the skin around both tear sacs in an infant, was also thought to be probably diphtheritic, tho the bacteriologic findings were negative. Steffens (quoted by Pes) obtained *B. diphtheriae*, staphylococcus and streptococcus in a diphtheritic gangrenous process of the lids without any conjunctival involvement. The case was that of a child, aged 6 weeks. Randall21 observed severe spontaneous gangrene of the lids in three healthy children of a family, aged 1, 3, and 5, but no conjunctival membrane is mentioned, and tho *B. diphtheriae* was found in one case, there were no other evidences of diphtheria, or any exposure to it, so its significance was questioned. Derby22 mentions these cases and that of Mori and Yamamoto. Other cases of gangrene of the lids have shown less resemblance to the present cases. Those due to anthrax and those occurring in erysipelas show little in common with them, nor do the cases occurring as a complication of measles, chickenpox, and whooping cough in rundown children.

One case of Morax’s23 is interesting as it occurred in a man of 44, two weeks after he had pricked his lid on a piece of straw. He suffered with fever and chills and enormous swelling of the right lids and cheek, with a row of herpetic vesicles on the lid borders. The phlegmon broke, forming six discharging ulcers, which healed in a few days. A virulent streptococcus was found. No membrane of the conjunctiva was mentioned, but the lids could not be opened for observation till the swelling had gone down, as in our Case 4.

Possek’s24 case had no membrane but is worth mentioning, as it occurred in one eye of a girl, aged 28, with nothing but a bad cold preceding it. Swelling of the lids was extreme, so that the conjunctiva could not be seen. Lymphatic involvement extended to the axillary nodes. On incision, no pus escaped, only a whitish lardaceous material, apparently much like that seen in our cases. Repeated cultures gave only *S. aureus*. He reports a similar case in a man, aged 32, also occurring without trauma, after a cold and fever. There was a slough of the superficial layers of one lid. No membrane is mentioned.

One case reported by Pes25 seems to resemble some of our cases more closely than any of the cases mentioned. It occurred in a peasant woman, aged 48, who was scratched on both of the lids and on the globe by a hen’s claw. Rapid swelling of the lids ensued, necrotic ulcers developing on the skin, with sinuses extending deep into the tissues. A thick pseudomembrane covered the ocular conjunctiva, the cornea became necrotic and panophthalmitis developed. Adhesions were left between the lids and globe. Staphylococci and streptococci were found in the smears. *S. aureus* was found only in cultures, the strain proving pathogenic for animals. His other cases were of severe gangrene of the lids in adult males, secondary to trauma, but no conjunctival membrane is mentioned. Photographs illustrate the lid conditions.

For the sake of completeness, one other type of case with skin lesions associated with membranous conjunctivitis may be mentioned. This is herpes iris, as described by Fuchs26 and Hanke.27 Various organisms have been found in the membrane; streptococci, staphylococci, and even one of
the B. coli group; but these are probably secondary, and the etiology of the skin lesion is not known. The diagnosis should be clear from the peculiar skin lesions elsewhere on the body, tho Hanke maintains that it may affect the conjunctiva alone.

Parinaud's conjunctivitis presents features which should serve to differentiate it easily from these cases. In it the conjunctival ulcers are typically discrete, without any diffuse membrane formation, the characteristic granulations are present, and skin lesions do not occur.

TREATMENT

In the diphtheritic cases, all now believe that antitoxin, as first used by Coppez, is the most important therapeutic agent.

Local treatment should consist chiefly in hot rather than cold compresses, and frequent irrigations with mild antiseptic solutions. During the stage of extreme swelling, the oculist is almost helpless, and perforations of the cornea often occur under careful treatment in the best hands, especially in the streptococcus cases. The emphatic advice of Coppez and de Wecker to avoid all unnecessary handling, and especially to avoid the use of solid caustics or strong silver nitrate solutions in this stage seems justified. If a later purulent stage appears, silver nitrate may be useful. It seems best, as Coppez states, never to try to remove the membrane, except small pieces for examination. He even advised against the trauma of frequent copious irrigations, and uses petrolatum with a small amount of iodoform or aristol on the lid borders and in the sac, removing only the fluid secretion with cotton several times a day, when the petrolatum is freshly applied.

Lemon juice has a traditional popularity in conjunctivitis with a membrane (Guibert28). Vian29 reports success with applications of crude oil to the membrane.

The use of antistreptococcic serum might seem indicated in cases of clear streptococcic origin, but in the presence of such complex bacteriologic findings as our cases showed hardly seemed justifiable. (In the one case in which the smears showed numerous cocci resembling pneumococci, polyvalent antipneumococcus serum showed no evident favorable influence.)

SUMMARY OF LITERATURE

Severe cases of membranous conjunctivitis due to B. diphtheriae show a great resemblance to our cases, often presenting their four main features. They nearly always occur, however, in young children, are usually bilateral and usually show involvement of other mucous membranes or a history of exposure to diphtheria. In these severe cases, the frequent corneal involvement has been of a deep character, usually with perforation or sloughing of the entire cornea in the absence of specific treatment. They have usually occurred in city dwellers, without a history of trauma.

The streptococcic cases may also show a great similarity, but skin lesions have been rarely reported, and these cases (Coppez, Harman) were in young children.

Some of the cases attributed to staphylococcus present many features in common. One of Hudson and Panton's cases, in a boy of 16, showed the membrane, skin lesions and swollen glands, and was severe only in one eye. Three of their other cases, two in girls of 7 and the other in a girl, aged 1 year, were somewhat similar, but with a more superficial membrane and milder course. Jessop's case was similar and was monocular, but was in a girl, aged 2 1/2 years.

In the cases of membranous conjunctivitis due to other organisms, skin lesions have apparently not been described.

Both of Morax' and Possek's cases of lid gangrene were monocular and occurred in adults, Morax' case evidently being that of a farmer with a history of trauma, but in them no conjunctival membrane was described.

The case showing most similarity to our cases was that of Pes, being monocular, in an adult peasant woman, and being accompanied by membrane on the ocular conjunctiva. Here the
simultaneous trauma to the lids and globe with accompanying infection was doubtless responsible.

CONCLUSIONS

1. Six cases were seen, all but two of which presented the common features of enormous swelling of the lids, swelling of the regional lymph nodes, superficial necrosis of the skin of the lids, and membrane on the conjunctiva. The other two, tho lacking one or two of these signs, were similar enough to warrant their inclusion as atypical cases.

2. All occurred in healthy adult or adolescent males engaged in outdoor occupations.

3. Three gave a history of slight trauma to the conjunctiva or lids. None had been exposed to diphtheria or showed any signs of it on other mucous membranes.

4. Mixed infection was present in all cases, the streptococcus, staphylococcus, B. xerosis and a large gram-positive anaerobic bacillus being found. The last was probably present in five of the six cases, and on account of the rarity of similar findings on normal lids or conjunctiva, is considered as possibly having an etiologic relation to the cases.

5. The cases seemed to form a distinct enough clinical picture to warrant their inclusion in a group for which the name "agricultural conjunctivitis" is suggested.

We wish to express our warmest appreciation to our chief, Dr. Harold Gifford, who saw most of the cases with us, and urged us to report them. Also to Dr. John T. Meyers and Dr. E. G. Cary, who went over some of the bacteriologic material with us.

BIBLIOGRAPHY