difficult to accept the view that waterlogging of the body should affect the labyrinth on one side only. It is reasonable to expect that both labyrinths would be involved and, being symmetrical, vertigo should not occur. Again vertigo is not a symptom in cases of dropsy subsequent to renal and cardiac disease. However, Mygind and Dida Dederding are in favour of the theory of waterlogging.

Palliative Treatment

Palliative treatment was carried out in the greater number of these cases. Rest in bed and the exclusion of all stimuli likely to produce vertigo, and a mild calomel purge with the administration of luminal (1/2 grain) or bromide, were usually successful. If the blood pressure is low ephedrine or ergotin may be given. Tobacco and alcohol usually aggravate the vertigo, and should be suspended. A careful and detailed investigation of the patient's method of living should be made to find any contributory cause. An attack of vertigo can sometimes be aborted if the patient resolutely fixes his eyes on some neighbouring object and so restores his equilibrium. The psychological element in these cases is very marked, and the patient should be encouraged and reassured. For this reason any definite and detailed line of treatment is sometimes successful, but the variety of drugs and treatments prescribed indicates that at present there is no real specific for vertigo. In spite of this a large proportion of these patients recover. There are a number of cases due to suppuration of the ear in which the mastoid operation alone has been entirely successful and satisfactory. The labyrinth has not been touched and labyrinthotomy or labyrinthectomy has not been necessary.

Operations on the Labyrinth

Operations on the labyrinth for vertigo are comparatively rare, because such an operation is only performed:

1. When the diagnosis that the vertigo is caused by the internal ear is certain.
2. When the vertigo is so severe and frequent as to make the patient miserable and unable to work.
3. When all other remedies have failed.

It must be remembered that the operation destroys the hearing and is not usually performed unless there is a considerable degree of deafness. The cases which fulfil these conditions are few and far between. Richard Lake, who specialized in this operation, performed the labyrinth operation in fourteen cases only. Many patients refuse to have any operation, and improve with palliative treatment. The most satisfactory operation is known as superior and inferior vestibulotomy, in which the ampulla of the external semicircular canal is opened by a fine chisel. The slit-like lumen of the canal is easily recognized. If the chisel is then applied to the little ridge of bone between the fenestra ovalis and fenestra rotundum the promontory is flaked off and the vestibule opened. The nerve ending is destroyed by removing the modiolus with a curette.

Complete excision of the semicircular canals, or labyrinthectomy, is not generally performed, and I venture to say that it is unnecessary.

I have done six cases of superior and inferior vestibulotomy with satisfactory results. Mollison's method of injecting alcohol into the external semicircular canal was adopted and, in addition, the vestibule was opened by removing the promontory. All six patients had had a previous radical mastoid operation. The vestibulotomy or labyrinthotomy was easily performed, and with the present-day technique was not dangerous. After the operation there was considerable post-anaesthetic vomiting, a riotous nystagmus, and increase of the vertigo, but within three weeks the wound had healed and the patients were discharged from the hospital quite well.

One patient who had had a radical mastoid operation done on both sides and was very deaf, had vestibulotomy performed on the right ear. The vertigo continued, and after an interval of three weeks a left vestibulotomy was performed with complete success. The operation has been done for tinnitus, but the result was negative and the tinnitus persisted.

About twenty-five years ago Ballance divided the auditory nerve within the skull to relieve a distressing case of tinnitus. The result was unsatisfactory. Cairns has carried out a similar operation of division of the auditory nerve for vertigo in four cases with success. Dandy has also done forty-two successful operations for vertigo, and, incidentally, in a few only has the tinnitus been relieved. This operation appears to be too formidable and too uncertain to be popular. Vertigo is not dangerous to life except when it arises from suppuration of the labyrinth, which may lead to meningitis.

Summary

Vertigo arising from the ear has distinctive features which make its recognition easy and certain. A hundred cases of vertigo have been classified according to their clinical etiology.

The pathology is discussed. There were no cases associated with high blood pressure. Lumbar puncture has produced negative results. The majority of the cases were given palliative treatment. The mastoid operations in cases of suppuration of the ear were very successful.

The indications for the destruction of the labyrinth or internal ear are the failure of palliative treatment, and a certain diagnosis that the vertigo arises from the ear.

EPIDEMIC STREPTOCOCCUS LARYNGITIS

BY

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AND

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"The evidence of modern bacteriology lends much likelihood to the view that epidemic diseases are constantly changing."—HANS ZINSSER.

From time to time medical practitioners have become acquainted with epidemic "sore throats" of streptococcal origin which have been traced to tainted milk or water supplies, and some of the outbreaks have not been free from a comparatively high mortality. In most of the cases the soft palate, fauces, tonsils, and upper pharyngeal regions have borne the chief brunt of the infection. Quite recently indeed (May 25th, 1935) Dr. F. E. Camps of Chelmsford called attention in this *Journal* to such an epidemic in that town at the end of 1933.¹ But according to information we have received from Dr. F. P. Sturm of Leigh, Lancashire, a streptococcus epidemic appeared there during last winter in which the *larynx* was chiefly affected. Reports from localities so widely separated, together with our own recent experiences in London, lead us to suspect that streptococcus throat infections, both pharyngeal and laryngeal, have recently been, and perhaps even now are, much more common and widespread than is generally realized. So far as we know, the laryngeal type of the disease, with which the present paper is chiefly concerned, does not seem to have been hitherto described, probably because the cases encountered have for the most part been mild and sporadic, and, being simply regarded as "influenza" or "a bad cold," have not been submitted to an expert examination of the *larynx*. Never-

theless, in this variety the larynx is chiefly or solely selected by the invading organisms; the course of the disease is subacute, and may be long drawn out; and, although seldom fatal, it may leave behind it a permanently immobilized vocal cord or cords and protracted or even permanent hoarseness.

We ought perhaps to mention that our interest in the disease was first aroused by its occurrence in one of ourselves. Consequently, we have had an opportunity of watching, as patient (D. M.) and observer (H. T.)—both laryngologists as it happens!—a hitherto undescribed laryngeal infection which, as already shown, may come within the survey of any medical practitioner. At the same time, the happenings in the course of the disease have furnished us with an explanation of the origin of those cases, hitherto undetermined, in which one or other vocal cord in an otherwise healthy larynx was later on found to be immobilized, and so apparently paralysed, but in which no lesion involving the origin or course of the corresponding recurrent laryngeal nerve could be discovered.

The following is a brief account of the case referred to:

Case 1 (D. M.).—On January 19th last, two days after a successful prostatectomy by Mr. Cyril Nitch, intractable and continuous hiccup set in. Next day the voice became rough and hoarse. There was violent paroxysmal cough, and the mucous expectoration contained streaks of fresh blood. Examination of the larynx by Mr. W. A. Mill showed the vocal cords to be red, congested, and approximating imperfectly as from muscular asthenia. A day or two later there was complete aphonia. About the same time the patient became aware of some obstruction to breathing in the larynx. These symptoms continued until February 8th, when H. T. saw the patient for the first time and found him "weak, weary, prostrate, and profoundly anaemic." (It may be interpolated that the haemorrhage at the operation was trifling.) Temperature 99° to 100° F, pulse 110. Breathing was slightly stridulous. There was complete aphonia, and attempts to speak were frequently interrupted by a toneless cough, which failed to expel secretions accumulating in the larynx. The soft palate was as pale as a wax candle. It was therefore a considerable surprise to find that the laryngoscope revealed a marked congestion and swelling of the laryngeal tissues and of those in the immediate neighbourhood. The free portion of the epiglottis was slightly swollen and oedematous, the aryepiglottic folds more so, and especially where they merged below into the arytenoids. These were represented by two large, pear-shaped, oedematous swellings, which encroached anteriorly on the vestibule of the larynx and posteriorly obliterated the pyriform fossae. Such obstructing elements, coupled with intense congestion of the ventricular bands, rendered it impossible to obtain any more than a fleeting glimpse of the middle third of each vocal cord, and their sluggish movements on attempted phonation. After the lapse of four or five days the swelling of the right arytenoid began to subside; stridor had disappeared; and a better view of the cords showed them to be absolutely motionless in the abducted position. During these early weeks the constantly recurring accumulation of secretions in and around the larynx set up violent coughing, and sometimes retching, just at the moment when the patient was falling asleep. By the end of February the inflammation had so far subsided on the right side of the larynx that the corresponding vocal cord, though still congested, had nearly regained its normal movement and the arytenoid oedema had disappeared. On the other hand, there was little obvious improvement on the left side. Even now (May 11th), with the patient once more out and about after an interval of nearly four months, although the oedema has disappeared the left arytenoid cartilage still shows defective movement on phonation. Both vocal cords are now normal in colour, but, owing to the restricted movement of the left arytenoid, adduction is incomplete, and consequently some hoarseness remains. At no time was any ulceration of the inflamed laryngeal tissues visible. The cough and the raising of blood-stained mucus continued for about three months. We must add that the vesical operation was rapidly recovered from.

Comment

This may be regarded as a severe though typical enough instance of streptococcus laryngitis. The hiccup, however, raises the question whether the infection had not also attacked the oesophagus. It is true that the influence of the abdominal operation cannot be altogether excluded. But the hiccup lasted for upwards of three weeks, and was accompanied and followed by acute pain during the passage of food, which was referred to the lower end of the oesophagus and the cardiac orifice of the stomach. Moreover, the pain continued, like the laryngeal symptoms, for three or four months, and was then succeeded by a capricious sensation of painful spasmodic stricture during deglutition at the same place. X-ray examination by H. K. Graham Hodgson, at this period, showed the oesophagus proper to be free from organic stricture. Consequently the patient is disposed to believe that the infection had induced, in addition to oedematous laryngitis, an oesophagitis and gastritis, with perhaps some superficial ulceration. This extension has not been reported before as far as we know, and Sturm did not come across any instance of hiccup in the Leigh epidemic. We have been able, however, to trace three other cases in London, only one of which, however, was under our direct observation, and one of them suffered from long-continued and painful oesophageal spasm.

Case 2.—Female, aged 46, was seized with a "bad cold" in October, 1934. She developed hoarseness and then aphonia. Cough was severe and paroxysmal, but there was no expectoration. Hiccup set in early in the course of the illness, appearing each time she ate anything and lasting for an hour or two. It was accompanied by pain and difficulty in swallowing referred to mid-thorax, and described as "something obstructing the passage of food that had to be pushed aside." So severe was it that she had occasionally to stop eating, and regurgitation took place with temporary relief. The hoarseness and cough disappeared after six weeks, but the dysphagia remained for no less than six months, and was associated with painful dyspepsia. In spite of all this the patient put on weight. The larynx was not examined until May, 1935, and then the cords were seen to be acting normally.

Symptomatology

Much of what follows regarding symptomatology we owe to F. P. Sturm (Leigh).

The disease appears in two forms: in the one, pharynx and larynx are both affected; in the other, the larynx alone is involved. In most cases the attack is sudden, hoarseness and violent coughing being the first symptoms. There is intense laryngeal redness, affecting the cords as well as the rest of the larynx, and extending to the rings of the trachea. In the course of a few days the hoarseness increases, ending sometimes in complete aphonia which may last for a week or two, while, as occasionally happens, if the inflammatory swelling that impedes the movement of the cords is slow in resolving, the voice will remain weak, toneless, and husky, it may be for several months. In the later stages we have noticed that the early bright red colour of the larynx loses its intensity and becomes dusky, while oedema is still present.

Pain is a common symptom, and sets in soon after the onset. Most people must have experienced the sensation of soreness that accompanies coughing during an ordinary attack of simple laryngitis, but in this streptococcal type the pain is severe, more or less continuous, and is referred to that side of the larynx which the mirror shows to be chiefly affected. It may persist along with the other symptoms for weeks or even months.

In the early stages a certain amount of inspiratory *stridor* from the narrowing of the laryngeal airway is not uncommon, the subjective sensation of obstructed breathing adding to the patient's discomfort. Dangerous dyspnoea arising from laryngeal oedema has not so far

been met with in Sturm's cases or in our own; but F. E. Camps reports death from this cause in fulminating cases as early as the fourth day. Here is a case that was saved by a prompt tracheotomy.

Case 3.—Some thirty years ago, one of us (H. T.) saw a patient in whom the laryngeal oedema had so obstructed the air passage that suffocation seemed imminent, and tracheotomy was at once performed without any anaesthetic whatever. The patient has lived in good health since, and, although he cannot dispense with the cannula because both cords have remained permanently fixed in the middle line, a useful if gruff voice remains, which can be used without a finger being placed on the tube.²

The cough of streptococcus laryngitis is characteristic, being paroxysmal, violent, but ineffectual, and it often culminates in vomiting as in whooping-cough. It is readily induced by drinking, particularly if deglutition is badly co-ordinated by reason of the immobility of one or other half of the larynx.

The almost invariable and somewhat alarming *haemoptysis* calls for remark. In Case 1 it appeared as early as the first day of the illness, and lasted for three or four months. The expectoration, mucoid or muco-purulent, is either streaked or tinged with blood, and occasionally a small stringy clot may be seen. It differs from the more ominous pulmonary haemoptysis in being of a dark colour. The patient in Case 1 was definitely of opinion that the blood came from the larynx and/or the air passages; but the observer is rather inclined to regard it as emanating from a superficial streptococcal ulcer concealed behind the cricoid.

The *pharynx* when involved appears bright red and inflamed, the lateral bands in particular being swollen, and small superficial ulcers or suppurating spots may be seen dotted about here and there over the pillars of the fauces and the tonsils. Considerable local tumefaction may develop, even, as in one of our cases, to the extent of simulating a peritonsillar abscess, but abscess formation is uncommon save with mixed infections. The cervical glands occasionally become enlarged and tender, and like the other phenomena may linger on in that state for several weeks before resolving.

Turning now to the *constitutional symptoms* we find them to be as a rule unexpectedly mild. Temperature is for the most part subfebrile. The pulse rate, however, is increased to 110 or more in adults, and general prostration with anaemia and leucocytosis may be present, as in Case 1. A prominent feature of most cases is free perspiration, particularly at night. Finally, the slow convalescence may be further retarded by the onset of cardiac symptoms, due to the influence of the streptococcal toxins on the myocardium.

Progress of the Disease

As we have indicated, the progress of the disease is often surprisingly slow, the inflammatory oedema of the larynx, unless it gives way to serum treatment, persisting sometimes for as long as six or eight weeks, and its subsidence is very gradual. We have known all the four cardinal symptoms—hoarseness, cough, haemoptysis, and pain—to linger on for three or four months, and, even after the disappearance of all the symptoms, some irregularity in the arytenoids and a certain lack of briskness in the movements of one or other cord may for a time persist. It is necessary, however, to emphasize the fact that these long-continued cases are exceptional; the majority recover completely and spontaneously from the throat infection in a week or two, and the recovery is often as sudden as was the onset. On the other hand, we ought also to mention that a recurrence of the symptoms after an intermission of several weeks

is by no means unusual whether the first attack has been mild or severe. It is obviously difficult to throw off the infection once it has obtained a hold.

Pathology

Cultures inoculated from the throat of Sturm's epidemic cases and our own sporadic cases have grown streptococci (haemolytic as a rule) in pure culture. It has come to our knowledge that occasionally the infection is mixed (staphylococci, *Micrococcus catarrhalis*, influenza bacillus), and in this event glandular and other abscesses have been observed. In most of the cases, however, the inflammation has not led to abscess formation, whether locally or at a distance. In like manner ulceration of the mucosa seems to be seldom induced, apart from the small shallow ulcers visible at times in the pharynx.

In comparison with the other manifestations of streptococcus invasion formerly observed in these regions, a matter dealt with by one of us two years ago,³ this present laryngeal variety has so far proved to be of moderate severity only, and in the majority of cases, as we have remarked, the attack is of brief duration, and is not followed by any permanent change in the voice. It would seem, indeed, that such mild streptococcus cases in epidemic constitute one variety of that vague disease so often labelled "influenza."

We have found that most of the instances of delayed recovery have occurred in people over middle life, an observation in harmony with our experience that the (hitherto unaccountable) fixation of one vocal cord has not been seen before middle-age. We must add, however, that in the Leigh epidemic a number of children were attacked.

The oesophageal symptoms, if attributable to the streptococcus infection, may conceivably arise either as a reflex from gastric irritation as from an ulcer in or near the cardiac orifice, or, as they closely resemble those of achalasia, they may be due to a streptococcus neuritis of the sympathetic innervation of the lower oesophagus.

Prognosis

We have already mentioned that in the Chelmsford epidemic a few fatal cases of glottic oedema occurred. In the Leigh epidemic only one case threatened to end fatally, in consequence of the streptococcus infection lighting up a chronic pulmonary tuberculosis. So that we may say that apparently the disease has been less dangerous than might have been supposed. Further, the recovery even of the voice is generally complete. Only in a small minority does ankylosis of the crico-arytenoid articulation lead to permanent fixation of one or other or, as in Case 2, both vocal cords. The state of the voice will then naturally depend upon the position in which the cords are permanently fixed. If one cord is fixed in abduction while the other is moving freely, some, and it may be a considerable, restoration of the voice may be acquired in the course of a year or two, the mobile cord crossing the middle line to make contact with its passive neighbour during phonation.

As we have already remarked, this experience has furnished us with an explanation of some, at least, of those cases, hitherto puzzling, in which one vocal cord in an otherwise normal larynx is found to be immobile as if it were paralysed. The discovery, as a matter of fact, may be accidental, the patient being quite unaware of the laryngeal abnormality. In 1933 Miss T., aged 46, was referred to me by the Church Missionary Society because of "voice fatigue" after much speaking. The right vocal cord was immobile in the adducted position. I saw her again this week (June 19th, 1935) and the condition remains the same. (H. T.)

There is no need to enter in this paper upon a discussion of the sequelae of streptococcus infection. All we require to say is that the laryngeal variety is no less liable to them than the others.

Diagnosis

Apart from influenza and simple acute catarrh, this type of streptococcus laryngitis in its early stages may be mistaken for Ludwig's angina, laryngeal diphtheria, whooping-cough, and a foreign body impacted in the larynx.

In Ludwig's angina the grave constitutional prostration and the more massive and intense inflammatory swelling of the pharynx and larynx and sometimes of the cellular tissue of the neck ought to prevent any mistake. Laryngeal diphtheria, in turn, will be excluded by bacteriological examination, which should never be omitted. A streptococcal false membrane may form in the pharynx, as in one of our cases, but it differs from the diphtheritic membrane in colour, consistence, and attachment. In pertussis, which is not infrequent in elderly people, the early symptoms may resemble those of streptococcus laryngitis rather closely, as it occasionally commences with laryngeal congestion and some hoarseness. But the hoarseness is slight; there is no laryngeal oedema; and, as time passes, the cough becomes unmistakable. Finally, when confronted with a sporadic case of hoarseness, paroxysmal cough, and stridor, the possibility of a foreign body impacted in the larynx should not be forgotten, even although the patient may have no recollection of having swallowed one, or, as in certain types of neurosis, prefers to conceal the fact.

Under this heading we may mention that it is quite within the bounds of possibility for the oesophagus to be infected independently of the pharynx and larynx, with consequent hiccup and spasmodic stricture. Such cases are differentiated from organic stricture by x-ray examination or by direct oesophagoscopy.

Treatment

When swabs from the throat give a pure culture of streptococcus of whatever strain, a suitably large dose (20 to 40 c.cm.) of anti-streptococcus serum is the logical therapy. Even, indeed, when a culture shows other organisms as well as the streptococcus this may be regarded as the chief enemy, provided that the symptoms already described are clearly manifested. Naturally the earlier the remedy can be given the better. Sometimes the "scarlet" variety of the serum answers best; at other times the "polyvalent"; at other times again neither seems to have much effect. Our own experience of serum treatment, necessarily administered rather late, has not been very encouraging. It may clear up symptoms for the time being and yet fail to prevent a recurrence a few weeks later. There is no need for us to emphasize the necessity of guarding, as much as possible, against the onset of anaphylactic phenomena.

Apart from such specific treatment, the symptoms will require attention. The disturbing cough can be soothed by steam inhalations, and heroin, judiciously administered. An emergency tracheotomy will be required if dyspnoea becomes threatening, and preparations should be made for the operation before the necessity has actually arisen.

Acknowledgements.—In addition to expressing our deep indebtedness to Dr. F. P. Sturm for furnishing us with a clear and detailed account of epidemic streptococcus laryngitis as he saw it, we desire to offer our grateful thanks also to Messrs. W. A. Mill and W. M. Mollison and to Dr. F. H. Teale for their generous assistance in dealing with Case 1.

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PUERPERAL STREPTOCOCCAL SEPTICAEMIA

A REVIEW OF PREVENTIVE AND CURATIVE MEASURES

BY

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Puerperal septicaemia has been for many years the prime factor in the causation of "maternal mortality." The question, therefore, of its prevention and treatment constitutes a problem of first-rate practical importance to the nation. Broadly speaking, and from the point of view of incidence reduction, much can be achieved by the adoption of three main measures:

(a) Education of the public in the enormous importance of ante-natal clinics, the establishment of which makes it possible for septic foci and other abnormalities to be detected *early* in pregnancy, and timely advice imparted in the matter of raising general resistance to infection.

(b) Confinement in a properly equipped institution (hospital or nursing home), where the application of strict aseptic principles can be so much more readily facilitated, not alone at the birth itself, but also at all subsequent dressings, when sepsis may readily originate.

(c) Speedy isolation of all suspect cases to an "investigation" department, whereby risk of infection to other patients is reduced to a minimum, and a confirmatory diagnosis made possible in surroundings unattended by undue risks to the patient herself.

As the majority of fatal cases are traceable to a strain of haemolytic streptococcus, I propose here to consider briefly the special preventive and curative measures that have been employed in the streptococcal variety of infection.

Vitamin Therapy

Prophylaxis.—As might be expected, the most important of the vitamins in relation to this condition is vitamin A, and its chief value lies in the sphere of prevention. By the exercise of its function to repair breaches in the lining mucous membranes it serves the useful purpose of fortifying local resistance, and the earlier it is employed in the period of pregnancy the more formidable is that resistance likely to be. The vitamin next in importance is vitamin D, which, by its utilization of calcium and phosphorus to meet the requirements of the body, contributes in no small measure to the maintenance of resistance generally. The main sources from which these vitamins may be derived are four in number—namely:

(a) The diet, which should include whole milk, wheaten whole-meal bread, butter, cheese, eggs, green vegetables, carrots, tomatoes, and fruit.

(b) Accessory vitamin foods.

(c) Vitamin concentrates, one of halibut-liver oil being particularly useful.

(d) Ultra-violet irradiation, whereby ergosterol in the subcutaneous fat is converted into vitamin D.

In the ante-natal ward of Belfast Infirmary the patients receive prophylactic vitamin therapy from all these sources, and among 162 normal deliveries of patients transferred from the ante-natal to the labour wards during the year 1934 there were only three septic cases. Rest and isolation from marital contact must, however, also be taken into consideration. In the same year, among 678 normal deliveries of patients admitted direct to the labour wards from outside hospital, the number of septic cases was 25. On standardizing these figures for purposes of comparison we find that among the patients confined from outside hospital the incidence of puerperal sepsis was twice as great as among those confined from the ante-natal ward. This result would very probably have been still more convincing had it not been for the fact that a large number of admissions to the ante-natal ward antedated the commencement of labour by little more than a week.

Curative.—Here chief reliance must be placed upon the employment of a selected potent vitamin concentrate in large therapeutic doses. It has to be borne in mind,