SOCIETIES' PROCEEDINGS

ROYAL SOCIETY OF MEDICINE—SECTION OF LARYNGOLOGY AND SECTION OF OTOLOGY

(COMBINED SUMMER MEETING, HELD AT BIRMINGHAM, JUNE 8TH AND 9TH, 1934)

June 8th, 1934

Chairman—MUSGRAVE WOODMAN, M.S. (President of the Section of Laryngology)

Organisms in Chronic Bone Infections of the Sphenoid

By F. A. PICKWORTH

(Director, Joint Board of Research for Mental Disease, Birmingham)

BACTERIOLOGICAL culture methods of saline wash-outs from the sphenoidal sinuses of Birmingham Mental Hospitals' patients indicate that the chances of finding organisms in any given case are 3 : 1, and of the organisms found, 40 per cent. will be streptococci, 50 per cent. staphylococci, 30 per cent. diphtheroids ; other organisms in proportion. Similarly, of swabs taken from the sphenoidal sinuses within an hour or two of death, only one in four will be found sterile, and further investigation will show 50 per cent. streptococci, 50 per cent. staphylococci, 30 per cent. diphtheroids and 17 per cent. *B. influenzæ*. Of eight cases, in which small portions of bone removed from the posterior wall of the sphenoid with aseptic precautions were examined by bacteriological culture, only two were sterile ; five showed streptococci, four staphylococci, one diphtheroid and two *B. influenzæ*. There can be no doubt that these organisms are actually present in the sinuses, but their clinical significance presents some difficulty. The only reliable method of determining whether these actually grow in the tissues or whether they are chance atmospheric deposits, is the examination of histological sections and the detection of the organisms *in situ*.

In carrying out this research, an important fact was first overlooked, namely that the organisms which exist for years under unsuitable conditions for rapid growth cannot be expected to show

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FIG. 1.
Diplococci in pituitary gland.



FIG. 2.
Diplococci in optic nerve.
From the *Journal of Laryngology and Otology*.[2]

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the geometrical regularity exhibited by young organisms growing in an unlimited volume of rich culture media, as is usually seen in the laboratory. Very little work has been done on organisms which are grown under unfavourable conditions, but it is known that the diphtheria bacillus so grown develops an incredible number of different shapes and sizes. Under the influence of acid or alkaline reaction of the media, the influenza bacillus also shows bizarre forms.

In common with the method of other workers, the search for organisms was originally restricted to the finding of geometrically perfect shapes. The object of this paper is to point out that such organisms do not represent the chronic form of organism which is growing in the tissues but are all *recent extensions* from these lesions. Such organisms are typically shown in Fig. 1, which illustrates organisms in a pituitary gland vessel—histologically proved to be a recent extension from a chronic sinusitis[1]; Fig. 2 illustrates organisms in the sheath of the optic nerve which are recent extensions from streptobacilli and Gram-negative cocci existing in a chronic sphenoidal infection[2]; and Fig. 3 shows organisms in the perivascular tissues of the carotid artery in the sphenoid. The latter are in relation to adequate oxygenation and nutriment, analogous to a large volume of rich culture media, and in consequence, show the shape and regularity of a row of billiard balls. The recognition of such organisms presents no difficulty, but this very fact also indicates that they are essentially *young* forms of organisms, probably of only a few hours' growth.

A sphenoidal sinus (Fig. 4) was selected for histological investigation of organisms because the chronic bone changes surrounding the sphenoidal sinus indicated a very long duration of the infection, and pus, containing cocci, was present both in the sinus and above the pituitary gland. The man died of pneumococcal meningitis, and it is quite apparent that the chronic infected sinus was directly related to the cause of death. Irregular Gram-positive filaments were occasionally seen in the bone, and it is possible that, had more sections been examined, we might have come across a few regular cocci, but as the main object was to find the causative organisms of the chronic (as distinct from the acute) condition, it was disappointing that a case which macroscopically seemed so definite showed no recognizable organisms in the bone.

The solution of the problem was afforded by another case[14] in which a chain of streptococci (Fig. 5) just below the sphenoidal sinus epithelium presented distinctive differences from the regular appearance seen in presumably younger growths of the same streptococcus growing on the surface of the epithelium. Instead of the expected geometrical regularity there are (a) triangular, (b) club shaped, (c) bacterial forms of the organism, and (d) irregular

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spacing in the filament. At a greater distance below the surface, the same streptococcus (Fig. 6) showed an irregularity of the Gram-positive elements in the filament, which was so marked that, unless the intermediate forms had been observed, one could not identify them as streptococci.

We were thus able to follow all stages between young perfect streptococci and the chronic inhibited form of filaments found in the bone of the sphenoidal infection illustrated by Fig. 4. With this experience we searched especially for filaments containing Gram-positive granules in other cases. This was done in 200 cases by decalcifying thinly sawn pieces of sphenoidal bone in 5 per cent. trichloracetic acid saline and then staining paraffin sections by Gram's stain; in 80 cases, i.e. 40 per cent., filaments containing Gram-positive granules were detected. Fig. 7 shows typical filaments in the sphenoidal bone.

The mutations of organisms has lately occupied much attention. Dochez and others (1932)[3] have recorded observations which suggest that the occurrence of "colds" may be associated with change of avirulent to virulent types of influenza bacilli. Many pathological organisms hitherto considered specific alter during culture or passage, so that the resulting organism is of an entirely different type from the original. *Bacillus typhosus*, for instance, will produce four types, each with different characteristics. Todd (1927)[4] and others have shown that virulent cocci can be inhibited by growing them in immune serum, the resulting cocci having different cultural characteristics and pathogenicity from the original. The same author (1930)[4] showed that, by cultivation under conditions of peroxidase formation, cocci could be reduced in virulence by about a thousand times. The avirulent strain is more resistant to antibacterial ferments (such as are present in human tears) than the virulent. Reactivation of the virulence could be accomplished by growing under conditions of maximum oxygen tension without peroxidase formation. Arkwright (1921)[5] and others have shown that organisms, when grown in immune sera, change from virulent "S" types to the non-virulent "R" types. He says: "In spite of the lack of virulence of the 'R' form, it does not appear to lack vitality and vigour for vegetative growth." Dawson and Avory (1927)[6] found that "rough" pneumococci could be reverted to the "smooth" form by subculture in the serum of animals immunized with "rough" pneumoccoci. Since normal serum usually contains sufficient antibodies to "rough" pneumococci to cause reversion as indicated above (Dawson 1928),[7] similar changes might be expected with virulent streptococci; also we have in this change an explanation of the widespread damage of distant organs which may occur, due to a focus of non-virulent (but potentially virulent) organisms.

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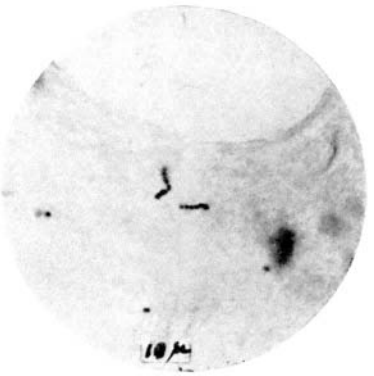


FIG. 3.
Streptococci in carotid artery.
From the *Journal of Mental Science*.[12]

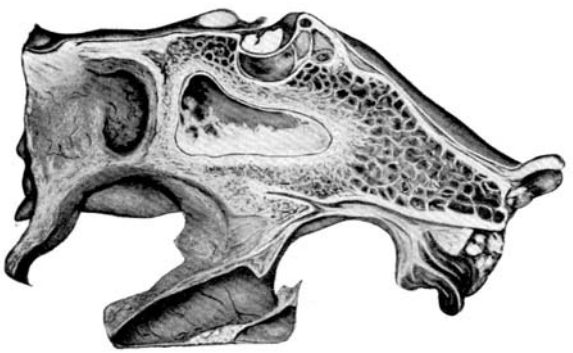


FIG. 4.
Chronic sphenoidal sinusitis. Bone changes, pus in cavity and over pituitary gland.
From *Zeitschrift f. d. Gesamte Neurologie und Psychiatrie*.[13]

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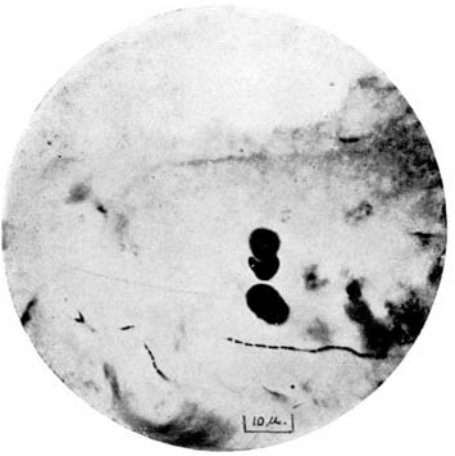


FIG. 5.
Streptococci under mucosa.
From the *British Medical Journal*.[14]

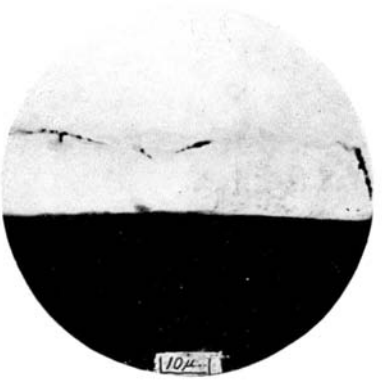


FIG. 6.
Streptococci near bone.
From the *British Medical Journal*.[14]

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Parish and Okell (1928)[8] found, as a result of injection of animals with virulent streptococci plus sufficient anti-serum to prevent a fatal septicæmia, that there was a "subacute infection towards the end of the first week, or later, characterized mainly by arthritic lesions, from which the hæmolytic streptococci can readily be recovered". Watkin and McKenzie (1929),[9] by culturing fragments of bone removed at operation for osteomyelitis, found organisms at a distance of at least one inch from the seat of manifest disease. Logan Turner and Reynolds (1931)[10] published a case of double infection in which chronic streptococcal sphenoidal sinusitis was followed by meningococcal meningitis and death; there were also acute *streptococcal* changes in the sinus membrane, bone, cavernous sinus, fifth nerve and pia mater. These acute changes could only reasonably be explained by the reactivation of an avirulent strain of the streptococcus, following tissue damage and diminished resistance of the host caused by the meningococci. An important case has been published by Rosenow (1927),[11] which clearly demonstrates the type of pathology related to our subject; the patient had chronic cystitis, sphenoidal sinusitis, and atheroma of the brain vessels; trauma of the bladder insufficient to cause harm to a normal individual set up a septicæmia, which caused fatal thrombosis of the cerebral arteries.

It is submitted that the filaments demonstrated represent inhibited streptococci which are actually growing in the sphenoid bone, and that the patient has a high antibody content in the blood to the particular organism with its virulent prototype. The reversion of the chronic form to the virulent presents many interesting problems. That organisms do actually exist in a viable state in bone infections is clinically recognized by surgeons who hesitate to open up any long healed chronic infection because of the danger of setting up an acute local infection or even a septicæmia by distributing the clinically dormant organisms.

The long duration of chronic infections of the nasal sinuses presents a marked contrast to systemic infectious diseases. Cases in which sinusitis existed over a period of ten years have been recognized. The macroscopic bone changes often found are evidence of a persistence of infection over many years; the associated clinical symptoms of one case suggested an infection lasting twenty-five years.

An illustration is given (Fig. 8) showing pus in the sphenoethmoidal recess of a child only three months old. The pus was the most striking macroscopical lesion seen *post mortem*; the clinical condition and cause of death were, however, ascribed to gastro-enteritis. Even at this early age sinus infection is an important cause of systemic disease and death; in recoverable infections the child forms antibodies to the organism, thus fulfilling the conditions

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by which a virulent streptococcus mutates to an avirulent type suitable for permanent establishment in the bony tissues of the skull. Such early bone sepsis needs correlation with irregularities in the development of the sinus as well as with the physical and social development of the individual.

A recognition of the fact that irregular Gram-positive granules within filaments seen in bone sections may be forms of inhibited streptococci, would materially assist research on bone sepsis and on the incidence and complications of nasal sinusitis.

REFERENCES

[1] PICKWORTH, F. A., *Proc. Roy. Soc. Med.*, 1928, xxi., 74.
[2] ———, *Journ. Laryng. and Otol.*, 1928, March, 186.
[3] DOCHEZ and Others, *Proc. Soc. Exp. Biol. Med.*, 1932.
[4] TODD, E. W., *Brit. Journ. Exp. Path.*, 1927, viii., 368. *Idem.*, *Journ. Exp. Path.*, 1930, 480.
[5] ARKWRIGHT, A., *Journ. Path. and Bact.*, 1921, xxiv., 36.
[6] DAWSON and AVORY, *Proc. Soc. Exp. Biol. Med.*, 1927, xxiv., 943.
[7] DAWSON, *Journ. Exp. Med.*, 1928, xlvii., 577.
[8] PARISH and OKELL, *Lancet* (i.), 1928, 746.
[9] WATKYN-THOMAS, F. W. and MCKENZIE, *Journ. Laryng. and Otol.*, xliv., 253.
[10] TURNER and REYNOLDS, "Intracranial Pyogenic Diseases," 1931, 81.
[11] ROSENOW, *Arch. Neur. Psych.*, 1927, xviii., 348.
[12] PICKWORTH, F. A., *Journ. Ment. Sci.*, 1932, lxxviii., 653.
[13] ———, *Zeits. f. d. Gesamte Neur. u. Psych.*, 1932, cxli., 420.
[14] ———, *Brit. Med. Journ.*, 1929, 721.

P. WATSON WILLIAMS said that members could not fail to realize the importance of this investigation of the sinuses; the slides which Dr. Pickworth had exhibited represented years of patient investigation. Of great importance was the peculiar chronicity of these conditions, the organisms penetrating the bone and other tissues and remaining more or less active, or at least ready for reactivation after long periods of quiescence. It was the clinical aspects, however, with which laryngologists were particularly concerned. There were many more cases in which the clue to successful diagnosis and treatment lay in the sphenoidal sinus region than was generally believed. Dr. Pickworth had shown that after the acute stage, the infection might persist for years, and could do infinite mischief. Cases of sinus infection in the child often presented systemic reinfections elsewhere. Probably when a definite infection became chronic the patient never threw it off completely, and it was liable to become reactivated even after a number of years. He (the speaker) wished that there had been time to refer to cases which showed the effects of reinfection; for example, he had intended to speak on cases of Frölich's syndrome in young boys in whom sphenoidal sinus infections were present and sinus disinfection produced favourable results.

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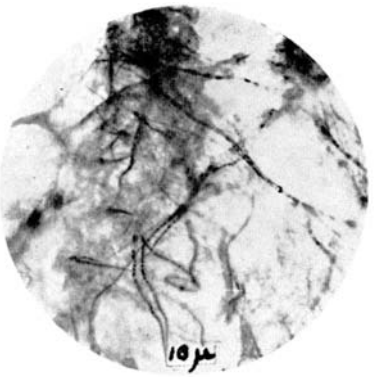


Fig. 7.
Streptococcal filaments in bone.
From the *Journal of Mental Science*.[12]



Fig. 8.
Pus in spheno-ethmoidal recess of a baby three months old.

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Royal Society of Medicine

Sphenoidal Sinus Disease in Mental Disorder

By T. C. GRAVES (Birmingham)

My contribution is an account of two cases,* representing a large number, to illustrate the continuation of that work on nasopharyngeal sepsis in mental disorder which has already been reported.

In these cases modes of treatment other than those having an action on the septic state are without avail on the psychosis; thus, the sedative drugs fail to remove the excitement of mania arising from closed foci of sepsis.

In the two cases now reported definite disease was present in the sphenoidal sinus and in both there was serious circulatory disturbance. The first was one of acute mania with cardiovascular intoxication, the second was one of mental confusion with optic neuritis and atrophy and other symptoms suggesting pituitary disorder—at one time suspected as pituitary tumour—and myocarditis. In both cases medicinal measures were without effect on the psychosis and associated sensory disturbances, but these were ameliorated and recovery ensued following surgical treatment of the nasopharyngeal sepsis, aided by non-specific therapy to provoke a focal reaction and so stimulate discharge of residual sepsis after drainage.

Case I.—Severe Acute Mania.—Female, hairdresser, aged 25. First certification on admission to mental hospital, *April 12th*, 1933. Discharged *November 3rd*, 1933. Recovery maintained.

History.—Since age of 21: Influenza twice, nasal catarrh and, later, cacosmia and cacogeusia, also headaches, principally right temporo-parietal, but also bi-frontal—at first one day a week, later continuous—and two nervous breakdowns, one of five months' duration. In 1932 patient was at work, but in autumn and ensuing winter depression, asthenia, and malaise appeared and intensified. She ceased work and lost weight. In *March*, 1933, severe abdominal pain with collapse was followed by undue excitement and unnatural elation by day and night. On admission to mental hospital severe acute mania, variable confusion, faulty habits, anæmia, cardiovascular instability, general asthenia, and dental sepsis were noted. The nasal passages and tonsils contained pus.

Course and treatment.—Terebene intramuscularly and a variety of sedative drugs by mouth and injection were given in *April* without improvement, in fact, digitalis, strychnine, brandy and oxygen were frequently required to combat circulatory feebleness

* Shown at the meeting held on June 9th.

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and collapse. Early in *May* anti-scarlet serum 50 c.cm. was given, and after this the patient was stronger and co-operated better. Sedatives were given but no collapses occurred. She even tolerated dental treatment of four extractions under general anæsthesia. General anæsthesia for a sinus examination on *May 30th* was not well tolerated but it was possible, by Watson-Williams technique, to examine the six sinuses. Pus was found in the right sphenoid and left antrum, and these were drained intranasally.

A course of non-specific therapy, using T.A.B. vaccine, was given. The patient was still maniacal and sedative drugs were still necessary as temporary palliatives, but the circulation was stronger.

On *August 1st*, under general anæsthesia, septic tonsils were removed by dissection, and from *August 8th* on alternate days a course of four intramuscular injections of colloidal sulphur was given. From then onwards the possibilities of recovery became more manifest, for after *July* sedative drugs were not required. The weight, which had fallen from 7 st. 6 lb. to 5 st. 13 lb., began to rise and at the end of *August* was 6 st. 2 lb. A further course of colloidal sulphur was given during *September*, and following this convalescence was assured. At the end of *October* the weight was 8 st. Patient now recognized that she had been mentally ill and was able to describe her experiences, including the development and, since the operations, the cessation of the sensory disturbances and catarrh. Objectively she was more stable, less irritable and more sociable. General muscle tone improved, shown in gait, carriage, and facial aspect and mobility. Facial colour replaced pallor. She was discharged from the mental hospital on *November 3rd*, 1933. She has remained well since then and has returned to work.

CASE II.—MENTAL CONFUSION, OPTIC ATROPHY, MYOCARDITIS, DYSPITUITARISM.—Housewife, aged 41. First certification on admission to mental hospital on *August 9th*, 1929. Discharged *April 12th*, 1934.

History.—Frequent severe headaches and influenza. Five normal pregnancies. Increasing weakness during last two years. During sixth pregnancy developed obesity, enormous appetite, enlarged thyroid and tremulousness, cyanosis and vertigo: periods of confusion and anger alternated with sleepiness. After delivery in *March*, 1929, this condition became worse, visual acuity was reduced and headaches were severe. Myocarditis was diagnosed and pituitary disorder suspected; sugar curve of pituitary type. No tumour found on radiography. Treated with pituitrin injections. Mental state became worse and patient was admitted to mental hospital.

Condition on admission.—Very feeble health, low blood-pressure and unstable pulse. Grossly obese. Purulent conjunctivitis and

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blepharitis. Pupils reacted normally, impossible to examine fundi. Wassermann reaction negative in blood. Confused, depressed, resistant, noisy and restless. Visual and auditory hallucinations. Perforation of both tympanic membranes and evidence of sinus and tonsillar disease.

Course and treatment.—Circulatory instability was increased by a profuse menstruation but at the end of the month she had rallied and her mental state appeared to be that of secondary dementia with hallucinations and excitement, for two years and a half. Amenorrhœa now followed and her condition during that time was such that only medical treatment could be given. She had sedatives, pituitary, ovarian, and parathyroid injections and tablets, tonics, potassium iodide, and gynæcological treatment. She lost 5 st. 2½ lb. and there was little change in her mental state; instability of equilibrium became more marked and she constantly fell to the right. With great difficulty her eyes were examined and bilateral optic atrophy suggestive of pituitary pressure was found. Her pulse at this time was 60. Lumbar puncture gave normal cerebrospinal fluid, not under increased pressure, although immediately after puncture she walked without falling. The findings now suggested that the pituitary damage was due not to tumour but to local toxæmia.

June 22nd, 1932. Nasal sinus examination revealed infection of both sphenoids (*B. influenzæ*), especially left. These sinuses and the antrum were drained intranasally. The patient improved mentally, becoming more intelligent and quieter, and sedative drugs were no longer necessary.

November 29th, 1932. Both septic tonsils were removed by dissection. Patient was now rapidly gaining weight and a definite mental improvement was apparent. She was quieter and more composed, and she slept well and was able to help in the wards, but during her menstrual periods she became confused, noisy and irritable. Although she was steadily improving, blepharitis, and sclero-conjunctivitis were now more marked than during the period of her acute illness and persisted in spite of adequate local treatment, especially on the left side. On *November 28th*, 1933, another sinus examination was carried out. The antrum was clear but the sphenoidal and ethmoidal sinuses contained flakes of mucopus.

A similar procedure on *December 19th* and other dates was followed by improvement in the conjunctivae and lids.

By this time the menstrual relapses were much less marked and were characterized by simple irritability with no mental confusion. She went home on leave, worked intelligently in the hospital laundry and was able to discuss her case with insight; this improvement continued. She was discharged on *April 12th*, 1934, and has remained well at home.

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REFERENCES

GRAVES, T. C. and PICKWORTH, F. A., *Proceedings*, 1928, xxi., 1267 (Sect. Laryngol., 45).
Idem, The Lancet, 1932 (ii.), 57, 115.
Idem, Journ. Ment. Sci., 1932, lxxviii., No. 322.
WATSON-WILLIAMS, PATRICK, "Chronic Nasal Sinusitis and its Relation to General Medicine," 2nd ed., Bristol, p. 70.

P. WATSON-WILLIAMS said that Dr. Graves could not be accused of rushing into the sinus treatment, as one of the patients had been a sufferer from the mental condition for over three years, and it was only his (Dr. Graves') feeling that the origin of the trouble might be found in the sinuses that had made him determine to investigate and treat the sphenoidal and other sinus infections present.

What struck those who saw cases of sinus disease not in asylums was the necessity, if possible, of seeing and treating these patients at an earlier stage. Failing this early recognition and treatment, there were many who would drift into lunacy, or something nearly as bad.

On the Control of Air-Pressure in the Lungs after Tracheotomy

By MUSGRAVE WOODMAN (Birmingham)

WHEN I was a house-surgeon I was impressed by a case of chronic intestinal obstruction with superimposed acute obstruction, the abdomen being much distended and the coils of intestine showing through the skin. The patient was much distressed, and he had a poor pulse. My chief carried out a colostomy and tied in a Paul's tube of suitable diameter, and out of this came large quantities of fæcal matter. At first this brought great relief, but with the passage of the fæces, anxiety increased, the pulse diminished, and within twenty-four hours the patient was dead. That impression has remained with me.

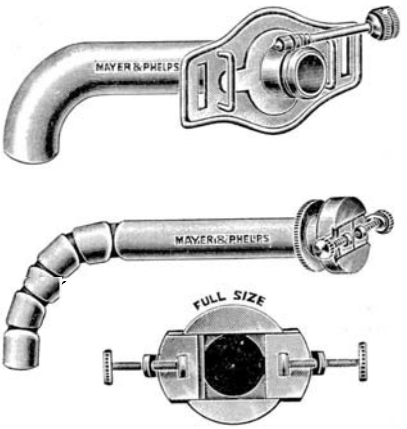
Three years ago a man came to me with chronic obstruction of the larynx; he had had this with increasing severity, for three or four months. He came into hospital, and we inserted a good tracheotomy tube, of wide bore. The relief from this was instantaneous, but lasted only for a few hours, at the end of which he began to get waterlogged. He had a cough, and mucus and saliva streamed out of the tracheotomy opening. Œdema and collapse of the lungs developed and the patient died. His death was due, not to pneumonia, but to complete collapse of the lung.

I have studied that case and similar ones, with the help of Professor Daly. It is evident that we must control the pressure in the trachea, just as we should, and probably do, control the pressure

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in colostomy when considerable pressure inside exists. Mr. Negus has shown us that the primary function of the larynx is sphincteric; it is not vocal. The question arises whether we are too abrupt in cutting out, by the tracheotomy opening, that sphincteric control which is the necessary and normal part of human physiology.

For that reason I have been using in my practice for two years, a valve of a simple character, designed to control this intratracheal pressure. It fits on to a Durham tube, and the size of the outlet can be readily adjusted by the nurse, but the outlet is never as large as the tracheotomy tube opening. The patient still has to work for breath, but less than before, and I instruct the nurse to give the screw a turn every hour, so as to widen it gradually to the extent



At the top of the illustration is an ordinary Durham outer tube. In the centre is the inner tube with the special valve locked in position. The lowest figure shows the detached valve with the flanges in the fully abducted position.

to which it ought to be widened. It can be removed from the inner tube for cleaning. The great importance of the valve is that it must be used immediately after the operation, when the distress due to the change is at its greatest.

Discussion.

V. E. Negus said that the larynx played an important part in controlling the inlet and exit of air into and from the lungs. He himself had designed a valve in this connection which, however, was not satisfactory, and he was interested to see one that had proved to be successful. The question of washing out carbon dioxide must be considered. Occasionally a patient underwent an apparently successful tracheotomy and subsequently died. The reason, he thought, was that the alveolar carbon dioxide in laryngeal obstruction rose from the normal 5·6%, even to 8%, and the alkali reserve had to be raised in proportion to fix the higher percentage of carbon dioxide

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in the blood. If tracheotomy was performed, the patient might, even in a few breaths, bring the alveolar carbon dioxide down to 5·6%. The lowered percentage of carbon dioxide in the blood was fixed and was not sufficient to stimulate the respiratory centre, which was set at a high level. The drop of this percentage and its fixation by the excess alkali reserve led to cessation of respiration, and possibly to death. The immediate indication was to give carbon dioxide. The valve would be of use in this respect if applied at the danger time, immediately after the tracheotomy. If springs could be fitted to Mr. Woodman's valve to control the size of the artificial glottis it would be an advantage, because the glottis opened at inspiration, and partially closed at expiration.

W. STIRK ADAMS said that this subject involved two problems. The first concerned the period immediately after tracheotomy. He could visualize two cases: In one there was acute œdema of the lungs. A child, aged 5, with obstruction from laryngeal diphtheria underwent an emergency tracheotomy, without anæsthesia. Blood-stained mucus poured out of the tube for twenty minutes after the operation, and the condition then subsided, with recovery of the patient. That was with a free tracheotomy tube. In the other case, laryngeal obstruction followed an influenzal acute upper respiratory infection. A man, aged 30, developed dyspnœa during the night and, when seen at noon on the following day, he was conscious but very distressed. He was propped up in bed, ashen grey in colour, and using all his accessory respiratory muscles; he tried to take his false teeth out and fell back unconscious. He (the speaker) had performed tracheotomy immediately, but although respiration was then free, the patient rapidly became water-logged and died twenty minutes after the operation.

The other problem concerned what might happen three or four days after operation, in cases of more chronic obstruction, in which there was a secretion of infective mucus.

The CHAIRMAN (in reply) said that he would be glad to try improvement on the lines which Mr. Negus had suggested. He again emphasized the importance of using the valve immediately after the tracheotomy; it was kept in readiness in the theatre for connection with the inner tube.

Speech Re-education Methods

By FREDA PARSONS (Birmingham)

I HAVE been asked to give a short demonstration of my methods in the teaching of phonetic speech sounds, especially in relation to patients with cleft palate and delayed speech.

The first essential in all this work is to arouse in the patient a keen interest and a joy in correct speech-formation. Before treatment a large majority of patients are mentally depressed owing to the

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realization of their speech inability, and this depression develops into a very sure sense of inferiority.

Speech training is necessary for all who find they are unintelligible through speech, according to the language in which they are speaking. Hindrance to normal speech is serious, for three main reasons: (1) Speech is the ventilator of the mind, and when normal speech formation is impossible or difficult, the personality becomes imprisoned. (2) Speech has been well described as "the trellis on which the mind can climb"; so that when speech is difficult the mind has no trellis, and mental development is hindered. (3) Speech is the chief means of social intercourse. If children, or even adults, are unable to speak they feel socially and otherwise inferior.

Speech-training must therefore give intelligibility to speech. I have not time to show my methods for people who stammer, or for those who have aphasia and similar speech defects. I shall merely show some exercises which I use in the treatment of cleft palate and delayed ability to speak.

I not only teach the formation of sounds but also the oiling of the speech machinery, thus giving it the flexibility necessary for the formation of ordinary voiceless stops and voiceless continuants. Then we pass to the teaching of tone-placing, and the importance of exercising the right "pull". The vowels will then fall into shape normally. For that reason we pay little attention to vowel practising; we concentrate on consonants, and indulge in conversational games.

I try to instil into my pupils a sense of confidence and ability and get them to take joy in this game of speech. I arrange different exercises every week to keep up the interest and excitement. Especially I get them to produce the sound through the mouth, not through the nose.

[Among the pupils demonstrated was a lady, aged 56, who had a complete cleft palate; she was wearing an obturator, and she had been unable to ring up anybody on the telephone, or to make herself understood in business. Her enunciation at the demonstration was not far short of perfect, and she had been able to resume her business without inconvenience.]

Discussion.

F. B. Gilhespy: In a discussion by the Section of Otology in 1932 on the Prevention of Deaf-mutism, I pointed out* that the pitch of the consonants was mainly situated in the region of 8,192 double vibrations a second (C_6 tuning fork), and that the vowel sounds were situated lower in the scale between 400 and 2,400 d.v. a second. A table from Harvey Fletcher's book, *Speech and Hearing*, gives the frequencies of the various vowels. If the hearing below 2,000 d.v. is lost, then

* *Proceedings*, 1932, xxv., 881 (Sect. Otol., 81).

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there is a great confusion in distinguishing certain vowels, apart from difficulty in hearing them, as certain pairs of the vowels have fundamental notes which are so close together that differences in frequencies would not be appreciated unless one of the pair possessed an overtone by which to recognize it; these overtones lie between 1,500 or 2,000 d.v. per second. It has occurred to me that the table given is too rigid as there must be some difference in pitch between the voices of males and females or soprano and baritone. This is the case, but is not very great in the spoken voice. In discussing this with Miss Parsons, she referred me to Aikin's scale, which I reproduce here, and this I think shows, more clearly than any table, the overtones used to distinguish vowels whose basal notes show very little difference in frequency. By knowing the pitch of the vowel AH in oneself, it would appear possible to know with what pitch we are testing patients when using vowels and consonants for the purpose. People with nerve-deafness fail first on their consonants. I must warn the members that after I had asked a patient suffering from nerve-deafness for a fee of three guineas, he, in good faith, handed me two; the mistake is explained by reference to the table and scale.

AIKIN'S RESONATOR SCALE.



OO	OH	AW	ŏ	AH	ŭ	ER	ă	ĕ	EH	ĭ	EE
Who	knows	aught	of	art	must	earn	and	yet	take	his	ease
400	500	600	700	825	1,000	1,500	1,800	1,900	2,100	2,200	2,400
					475	500	750	550	550	450	375

(Figures represent characteristic frequency of the vowel sounds.—FLETCHER.)

A simple experiment demonstrates phonetically that we use the overtone to distinguish OO and EE. If these vowels are whispered with the ears blocked, they cannot be distinguished by the speaker, as only the low tones produced in the pharynx are heard, while with the tongue raised in the mouth, the high overtone of EE is projected through the lips. The facts which I have mentioned are not new ones, but they have practical importance in teaching the deaf, and possibly may find some application for us in routine testing of deaf patients. It appears germane to this discussion to point out how little is taught of phonetics in our standard textbooks on ear and throat work, apart from the remark that a patient must rest his voice or an accusation of faulty voice production.

E. A. PETERS referred to an instrument, the multitone, one of which would be exhibited during the next session. It had an ingenious arrangement, whereby, in case of deafness, it would be possible to reinforce either overtones, or the fundamental lower tones in one or both ears.

RITCHIE RODGER said he had made a few tentative experiments with regard to the pitch range of the human voice, which he mentioned

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in a paper many years ago. Other observers had placed the average range of the speaking voice higher than he had found it at that time, but he still thought the ordinary range of the voices heard at meetings was between 200 and 250 double vibrations per second. He did not know whether Mr. Gilhespy could explain the vowel and consonant sounds being so much higher in the series which he had shown previously.

SYDNEY SCOTT said he had once examined with the Bezold-Edelmann series of forks a patient who could hear *nothing* above 1,000 vibrations a second by air or bone, yet was able to hear certain spoken words if the conversational voice were raised.

W. M. MOLLISON: That patient must have been educated to hear without the S and the P.

ABSTRACTS

EAR

Physiology of the Ear. W. HUGHSON, S. J. CROWE and HOWARD A. HOWE. (*Acta Oto-Laryngologica*, XX., 1-2.)

Amongst the facts which have been demonstrated and previously reported from this work carried out at Johns Hopkins Medical School, in which the so-called Wever and Bray phenomenon has been used to measure the effect of the different procedures, the following are mentioned in review. Circumcision of the tympanic membrane has practically no effect on the transmission of tones. Fixation of the tensor tympani muscle produces a loss of transmission of low tones, this muscle contracts reflexly following stimulation of the pinna, the external canal or the facial nerve. Immobilization of the secondary tympanic membrane by a periosteal graft greatly increases the intensity of tones transmitted. Intra-labyrinthine pressures have been measured and the relationship between cerebro-spinal fluid and intra-labyrinthine pressures reported. Decreased intra-labyrinthine pressure produces a decrease in intensity of all tones and usually a complete loss of high tones, whilst increased pressure has practically no effect. The writers have developed a method for the experimental investigation of bone conduction.

Improvements in apparatus have recently been developed; for example a pitch range audiometer has replaced the oscillograph and the error due to bone-transmitted sounds appears to have been overcome. It has been the custom more often to rely on short experiments to eliminate the possible errors of long-drawn out procedures, and therefore a single piece of information alone has been sought in each experiment.

Several experiments are described to demonstrate:—(1) How the intensity of the transmitted tone is greater when received

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