BRITISH MEDICAL JOURNAL

LONDON SATURDAY DECEMBER 18 1948

THE INCIDENCE AND TREATMENT OF INFECTIVE EAR DISEASE IN FACTORY EMPLOYEES*

BY

COLIN M. JOHNSTON, M.S.†

A serious cause of wastage of man-power in the late war was due to disease of the ear. Thus during February and March, 1943, at four large military hospitals in the United Kingdom 11,956 out-patients were seen, of whom no fewer than 1,517 (12.7%) were suffering from diseases of the ear, nose, or throat. Of these 1,517 cases approximately one-half (6%) were due to all forms of disease of the ear and one-quarter (3%) to chronic suppurative otitis media. Thus it was shown that chronic ear disease caused a serious loss of fighting man-power in time of emergency. There was good reason for believing that this serious state of affairs had its basis in the high rate of ear disease prevalent in the civilian population, and this was strikingly confirmed by the results of a study of the records of the Ministry of Labour and National Service Boards, which revealed that just over 2% of the recruits examined were rejected on account of chronic ear disease, while diseases of the ear were responsible for 10% of the total number rejected from all causes.‡

Now chronic ear diseases, in particular C.S.O.M., are well known as potent causes of inefficiency, invalidism, or early death. Occupational groups such as food manufacturers, shops, the General Post Office, and life assurance companies recognize their importance and may penalize the sufferer by refusing him employment or insurance as the case may be. The high incidence of the disease, emphasized by wartime experience, therefore demanded consideration in the planning of the health services of the country, and the present study of the incidence, prevention, and treatment of chronic ear disease in a sample of the civilian population owes its inception and design to the committee of the Medical Research Council appointed to advise upon the medical and surgical treatment of deafness.

Much information about ear disease in children had already been obtained from the school medical services. The methods and results of treatment of the disease in hospital practice were well known among otologists, but little knowledge of the incidence in the adult population was available, and there was general dissatisfaction about the results of treatment. The work carried out during the war by otologists in the armed Forces and the civilian emergency medical service demonstrated on a large scale the validity of previous observations. These showed that good results were obtainable with conservative treatment. Thus by regular daily treatment Banham§ was able to

obtain a dry ear in 82.5% of 200 cases of chronic suppurative otitis media occurring in R.A.F. personnel. This result strongly suggested that the high incidence of chronic suppurative otitis media in the civilian population is mainly due to neglect—a neglect which arises in large part from the patient's inability, for economic reasons, to attend regularly for treatment. Attendance at the panel doctor's surgery means that patients often have to leave the office or factory before completion of the day's work and then wait for several hours before being examined. Owing to pressure of work the practitioner is unable to do more than prescribe ear drops, which usually fail to cure the condition. Attendance at hospital for specialist advice and treatment also entails absence from work, which may cause very considerable loss of wages. Even when facilities are available at the hospital for treatment after the patient's working hours—and this is exceptional—there will be a considerable interference with leisure. The patient may be prepared to sacrifice wages or leisure for short periods or for painful and disabling conditions, but the slight symptoms of most cases of chronic ear disease seldom impel him to endure the discomforts and losses resulting from a course of treatment which may extend over several months.

The only reasonable alternative would appear to be treatment given at or near the place of work. An ear-treatment clinic organized at the factory or office would obviate the time spent in travelling to the hospital and would enable the sufferer to obtain regular treatment during his working hours. An industrial area containing large factories would provide the necessary clinical material, and it was accordingly decided to investigate the possibilities of treating chronic suppurative otitis media in factory clinics situated in such an area.

After negotiations with the Industrial Health Research Board and a group of industrial medical officers I was appointed as a full-time otologist to carry out an investigation in factory clinics in the Birmingham area.

The investigation falls into two sections. First, a survey was made to determine the incidence of ear disease in the population of the factories concerned. Secondly, an attempt was made by means of a field experiment to determine the value of the factory clinics in treating ear diseases in the associated population. The work done under both of these headings forms the subject of the present report.

Introductory Note on Factory Medical Services

Before the late war many factories employed a trained nurse and some a part-time or whole-time medical officer. During the war the large influx of unskilled labour and the longer working hours made an extension of the factory medical service essential, and many of the larger factories

*An abridged version of the report presented by the Medical Committee to Advise on Medical and Surgical Problems of Diseases of the Ear, of the Medical Research Council.

†In receipt of a whole-time grant from the Medical Research Council.

‡The above data were obtained from a report on "Chronic Suppurative Otitis Media in the Army" presented by Brigadier M. L. Formby to the Medical Research Council (M.S.D.17).

§Banham, T. M., *J. Laryng.*, 1944, 59, 117.

developed a well-equipped medical organization directed by one or more full-time medical officers and staffed by State-registered nurses. Their value in safeguarding the health of employees has been proved, and the retention of industrial health services in the future is probably assured. In a few factory clinics the conditions equal those of a hospital casualty department and a diagnostic x-ray plant is available. Ophthalmic, dental, chiropody, and physiotherapy treatments are available, and are conducted by visiting specialists or by trained staff. Treatment and advice by the specialist are by appointment, during working hours. Workers appreciate this, and managements are satisfied that the results obtained warrant both the small capital expenditure entailed and the small loss of the worker's productive time.

Where the factory covers a large area the medical organization usually includes a central medical department with one or more dressing stations, in order that the employee shall not have to walk too great a distance from his place of work. This is of value in facilitating the early treatment of minor cuts and preventing sepsis, and where the condition requires daily or more frequent attention less time will be lost from productive work.

In the present conditions of the five-day working week factories where continuous processes are not employed close at week-ends and during public and works holidays. The medical department will also be closed during those times and continuity of medical treatment interrupted. In factories where night work is carried out the dressing station may be manned by a male nursing orderly who, though well experienced, has had only first-aid training.

Thus, apart from the drawbacks already mentioned, the factory medical services have all necessary facilities for the treatment of minor complaints, and many of the difficulties expressed by sufferers in obtaining treatment elsewhere are thereby overcome.

It should be stressed that the primary function of the factory medical service is to maintain the working efficiency of the employee and to prevent accidents and ill-health occurring at the place of work. It is not held that infective ear disease is an industrial hazard, but it may be detrimental to effective working capacity. Alleviation will therefore come within the purview of the industrial health service, but from the point of view of the factory management the loss of production caused by the time spent on treatment must be balanced by an increased efficiency for work. This should be demonstrated by a decrease in absence due to sickness.

SECTION I

Survey to Ascertain the Incidence of Ear Disease in the Factory Population

In order to gain an estimate of the incidence of chronic infective disease of the ear in the factory population a survey has been conducted of a random sample of the workers in four factories in Birmingham.

Experience gained during the survey confirmed the opinion previously held, that statements by individuals regarding not only the degree but even the presence or absence of ear symptoms were inaccurate. Thus several individuals, after stating that their ears were healthy, expressed surprise on being shown pus removed from their ear. A person's assessment of the acuity of his hearing varied from those professing some deafness, when the hearing was found to be normal to rough testing, to the others who, severely deaf, will only with reluctance admit even a slight loss of hearing. It was therefore essential for the purposes of accuracy to examine the external auditory meatus with an aural speculum and adequate lighting.

Care was taken to explain the objects of the survey before permission was asked to examine the ears. Out of 1,902 individuals examined only 14 refused to co-operate, and there was reason to suspect that a proportion of these suffered from ear disease and for a variety of reasons did not wish to divulge the fact. Owing to the limitations imposed on the length of the examination due to the necessity for avoiding interference with factory production, cerumen could not in all cases be removed, nor could an attempt be made to assess the cause or degree of any deafness. The presence of cerumen was noted if in an amount sufficient to obscure a view of the ear-drum.

Results

The survey was conducted over a period of 13 months from August, 1946, to September, 1947. Table I shows the incidence of ear disease in the total sample examined. It may be noted that the numbers refer to the individuals affected and not to the number of ears.

TABLE I.—Incidence of Ear Disease in the Total Sample

Individuals examined:	No.	Percentage Incidence
	1,902	100%
1. Cerumen:		
Unilateral	239	475 } 25%
Bilateral	236	
2. Otitis externa:		
Membrana tympani intact	49	2.6%
3. Scarring without perforation of the membrana tympani:		
Unilateral	153	220 } 11.6%
Bilateral	67	
4. Dry perforations of the membrana tympani:		
Unilateral	28	31 } 1.6%
Bilateral	3	
5. Active suppurative otitis media:		
Unilateral	48	62 } 3.3%
Bilateral	14	
6. Healed cortical mastoidectomy:		
Middle ear dry: Unilateral	16	19 } 1%
Bilateral	1	
Middle ear infected: Unilateral	2	
7. Healed radical mastoidectomy: Unilateral	7	0.4%
8. Otitis media, active and healed. (Sections 3, 4, 5, 6, and 7)	339	17.8%
9. Bilateral otitis media. Active in one ear or both	39	2%
Bilateral otitis media. Healed in both ears	88	4.6%
10. Healed mastoid operations. (Sections 6 and 7)	26	1.4%

Table II shows in a summarized form the incidence of ear disease in different age and sex groups.

TABLE II.—Incidence of Age and Sex Groups in Sample

	Male	Female	Total	Percentage
Under 20	249	69	318	16.7%
20 to 29	369	140	509	26.8%
30 to 39	364	45	409	21.5%
40 to 49	292	37	329	17.4%
50 to 59	211	17	228	12.1%
60 and over	104	5	109	5.7%
Total	1,589	313	1,902	100%

SECTION II

Organization of Factory Ear-treatment Service

The organization of the factory medical department, designed to suit the needs of the group it serves, differs in many ways from that of a hospital. An ear-treatment service must therefore adapt itself to the altered conditions, and, although in this investigation the treatment has been similar to that of the hospital, some modifications have had to be made in the light of experience. As these modifications have had an effect on the results of treatment they should be considered when comparing results with those derived from hospital practice. A permanent basis for an ear-treatment service would doubtless diminish, but not abolish, these differences.

Facilities available in factory medical departments have been found adequate for the treatment of chronic ear disease

with the exception of certain deficiencies. Intermittency of treatment, the lack of certain diagnostic aids, and to some extent lack of the greatest possible skill in treatment by the nursing staff have militated against full efficiency. Discussion on these latter points will be found in the section on the treatment methods employed for chronic suppurative otitis media.

Results of Factory Ear-treatment Service

The results reported in this paper have been derived from work carried out in seven large factories situated in the city of Birmingham, employing in all 51,900 employees. A considerable proportion of these workers were not natives of Birmingham but had spent their childhood elsewhere in Great Britain or in Eire. All these factories have well-equipped and efficient medical departments with the facilities already outlined.

Table III shows the clinical conditions encountered. An analysis of these cases, and the results of their treatment, will now be considered.

TABLE III—*Clinical Conditions Encountered*

Condition	No. of Patients
Cerumen	255
Otitis externa	389
Other conditions of pinna and meatus	24
Acute otitis media	26
Chronic suppurative otitis media	274
Healed otitis media	249
Healed cortical mastoidectomy	26
Healed radical mastoidectomy	44
Eustachian obstruction	65
Clinical otosclerosis	26
Conductive and mixed deafness of unknown aetiology	20
Perceptive deafness	117
Conditions of ear not already classified	32
Conditions of the nose and throat	78
Suspected disease of ear, nose, or throat—nothing abnormal found	62
Other conditions of head and neck	24

Cerumen

These patients were referred to the otologist because of pain or deafness, and removal of the cerumen revealed no other abnormality of the ear. Cases where another ear condition was found have not been included under this heading.

Most cases of cerumen coming for treatment at the factory surgery are referred by the nursing staff to the panel doctor in charge of the case. Some, for one reason or another, prefer to obtain their treatment in the factory surgery and are dealt with by the nursing staff. A few, because of pain or difficulty of removal of the cerumen, were referred to the otologist. 255 patients were seen. Six examples of keratosis obturans were observed. The meatus was restored to normal in each case as a result of treatment.

Otitis Externa

Furunculosis.—The majority of the cases were solitary and not followed by a subsequent attack. The condition was observed more commonly in young adults, usually female, or in individuals who had a slight abnormality of the meatus. Thus in the opposite meatus the cerumen was scanty and stiffer in consistency than the normal, or there was an absence of cerumen with a few dry epithelial scales.

Treatment.—Any epithelial debris and pus lying in the meatus were removed by the otologist as a preliminary measure. When available, diathermy (inductotherapy) was given and relieved the pain in under 48 hours. Alternatively ichthylol preparations were applied on a gauze wick until the pain subsided. In an attempt to prevent recurrences, drops of ung. hyd. nit. dil. in liquid paraffin, 1 in 8, were instilled daily for a week or longer.

In no case observed was it necessary to employ vaccine therapy or such preparations as colloidal manganese.

Acute Otitis Externa

This condition was more often seen as an exacerbation of a chronic condition, but it also occurred *de novo*. The latter condition only will be discussed in this section.

In some cases a history of previous attacks was present. The initial attack was occasionally caused by furunculosis or occurred during service in the armed Forces. The entrance

of infected water into the meatus, as in sea or fresh-water bathing or washing, appeared to precipitate an attack in some cases, while the constitutional effect of acute coryza, dietary indiscretion, or dental extraction in the causation was observed. In others an active chronic suppurative otitis media was present. Otitis externa occurring during the course of treatment of otitis media was a troublesome complication and in the majority of cases followed the use of insufflations containing sulphanilamide. It appeared to be a true sensitization, as the previous continual use of such a preparation in the ear was without ill effect. Less often otitis externa followed the use of spirit drops or iodine and boric powder insufflations.

In the most severe cases the meatal lesion spread over the lateral surface of the pinna and involved the surrounding skin of the cheek and neck, forming an acute weeping eczema.

Treatment.—Care was taken at the first and subsequent examinations to remove scrupulously all pus and epithelial debris from the meatus, paying particular attention to the anterior and inferior parts of the junction between the meatal wall and the tympanic membrane. Afterwards the ear was mopped out daily with dry cotton-wool-tipped probes by the nursing staff.

Of the medicaments used, 1% aqueous gentian violet solution, 50% spirit containing $\frac{1}{2}$ % gentian violet, aluminium acetate solution 4%, and calamine lotion were found to be of the most use. Gentian violet very rarely caused exacerbation and appeared to be more effective when combined with spirit as above, but in some cases resolution was slow. Aluminium acetate applied on $\frac{1}{2}$ -in. (1.25-cm.) -wide ribbon gauze packs gave excellent results in some cases, but occasionally failed or, worse, caused severe exacerbation. For lesions of the pinna, gentian violet, while giving good results, was disfiguring to the patient. Calamine lotion could be satisfactorily substituted in most cases, but results were more rapid with a mixture of equal parts of the aqueous gentian violet solution and calamine lotion.

Penicillin ointment (500 units per gramme) applied on a wick of ribbon gauze gave excellent results in some cases, but in many cases it caused an exacerbation, often severe. It was not determined whether this was due to sensitivity to penicillin or the ointment base, insufficient concentration of penicillin, or the growth of penicillin-resistant organisms.

When the condition had resolved and treatment was discontinued the patient was requested to return one week later to confirm the cure.

Chronic Otitis Externa

This condition was diagnosed when irritation or meatal discharge had been present for at least a month with no evidence of spontaneous cure. Many cases gave a history of acute attacks at intervals, and in some the cause of these attacks appeared to be the same as those already mentioned under the aetiology of acute otitis externa. The occurrence of intercurrent attacks of furunculosis has already been mentioned.

The severe cases varied from those of comparatively recent origin, where the meatus was filled with offensive epithelial debris and cerumen, to the old-standing case with gross oedema and sub-epithelial thickening of the meatal walls and pinna. The mild cases showed an absence of cerumen, or pale offensive cerumen was present. If the meatus was moist the pus was offensive and flaky, and if dry the meatal walls were covered with dry scales.

Self-treatment with peroxide of hydrogen, some glycerin preparations, or unsuitable proprietary applications was found to cause an acute otitis or exacerbate one already present. Some patients stated that the condition was made worse by washing with soap and water. Patients working on grinding or cutting machines where suds (composition: soda ash, 28 lb. (12.7 kg.); soft soap, 43 lb. (19.5 kg.); water, 100 gallons (455 litres)) were employed as a lubricant and cooling agent would scratch an irritating ear with the soiled hand, and some resistant cases involving the pinna were cured when a scarf was worn round the head during work. Associated seborrhoeic dermatitis of the scalp was infrequent.

Treatment.—As in the acute form of the disease, scrupulous removal of the pus and epithelial debris was practised. Occasionally, in addition, the patient was instructed how to cleanse

his meatus with dry cotton-wool-tipped probes when daily treatment could not be given by the factory nursing staff. In the isolated case this appeared to hasten a cure.

The choice of medicament lay between those held in a watery base and those in an oily or greasy base. As a rule, dry lesions of the meatus reacted best to oily preparations such as pigmentum hyd. nit., ung. hydrarg. ammon. dil., Lassar's paste, or zinc and castor oil cream. In the atrophic type of ear the use of a preparation such as pig. hyd. nit. was prolonged, and the applications continued at increasing intervals. Moist lesions were treated with gentian violet or aluminium acetate solution.

Otitis Externa with Granulations

Sessile granulation tissue arising from the meatal walls or external surface of the ear-drum occurred with the acute, sub-acute, and chronic forms of otitis externa. When the granulation tissue arose from the ear-drum the differential diagnosis from otitis media was made by the absence or slight degree of deafness, the appearance of the unaffected portions of the ear-drum, and the absence of fresh pus from the affected area when negative pressure was applied with a Siegle's speculum. The granulation tissue could arise from any part of the tympanic membrane, but was more often seen on the membrana tensa. Multiple sites of origin were more common than solitary sites. Healing was slow, but when complete a scar did not result. Several patients were seen again with a recurrent attack and the granulations then usually sprang from the areas previously affected. Concomitant herpes labialis or acute coryza did not occur in these cases.

Treatment.—The meatus was cleansed by frequent or daily dry mopping, and 50% surgical spirit was instilled. The granulations were touched with trichloroacetic acid solution at weekly intervals.

Results of Treatment of Otitis Externa

Table IV shows the number of patients seen, the number and percentage of recurrences, and the average duration of

TABLE IV.—*Otitis Externa*

	No. of Patients Seen	No. of Recurrences	Average Duration of Treatment in Weeks
Furunculosis	48	10 (20%)	1.2
Acute otitis externa	110	10 (9%)	1.8
Chronic	218	45 (20%)	2.8
Otitis externa with granulations	13	1 (7%)	3.5

treatment. It will be seen that furunculosis and chronic otitis externa have a high recurrence rate (20%). In 54 patients the condition was so slight that no treatment was considered necessary, and 71 other patients did not complete the treatment. The remainder were cured.

It must be stressed that no deductions can be drawn about the efficacy or the duration of treatment. This part of the investigation was not planned to determine the comparative efficiency of various forms of treatment; descriptions of the methods used have been mentioned only to indicate the range of treatment. The disease has been found to cause more pain, with resulting loss of working efficiency, than chronic suppurative otitis media, and considerable care and treatment have been necessary for its alleviation.

Other Conditions of Pinna and Meatus

Otitis Externa Bullosa and Haemorrhagica.—These conditions were seen in 11 patients, in all of whom the condition was unilateral. In 6 of these cases the vesicles were filled with blood. Concomitant otitis media was observed in 1 case.

Osteoma of the External Meatus.—The condition was seen in 6 patients, and in no case was the meatus obstructed or the hearing affected.

Developmental abnormalities.—One case of complete atresia of the external meatus and maldevelopment of the pinna associated with gross perceptive deafness in that ear was seen. The function of the other ear was apparently normal. In another case an accessory auricle was present, consisting of an irregular fleshy projection arising from the cheek just in front of the left tragus. The pinna, external meatus, and tympanic membrane were normal, and there was a mild presbycusis, equal

in both ears. In neither case was there a familial association. Five examples of developmental stenosis of the meatus were encountered.

Acute Otitis Media

This term is limited to those cases where the history and the physical signs provided no evidence of a previous attack of otitis media. Those cases in which previous attacks had occurred will be described under recurrent chronic suppurative otitis media.

Non-suppurative Acute Otitis Media.—Pain, deafness, and an acute upper respiratory infection were present in all cases. The appearances varied from localized dilatation and redness to generalized redness and bulging of the tympanic membrane.

Treatment.—Where the inflammatory changes in the tympanic membrane were slight and localized, spirit ear-drops were instilled daily to sterilize the meatus, and steam inhalations were given twice daily to combat the nasopharyngeal infection. The other cases were referred to the patient's medical practitioner for treatment by chemotherapy.

Results.—Sixteen cases were seen, all unilateral. Five patients were not seen again. The remaining 11 ears resolved, and in all except one case the hearing was restored to its previous level.

Suppurative Acute Otitis Media.—In all the cases perforation of the tympanic membrane had already occurred. An acute upper respiratory infection was held to be the cause in 5 cases; the remainder were due to local trauma from blows on the ear or the insertion by the patient of such objects as match-sticks or "Kirby" hair grips to allay irritation of the external meatus.

Treatment.—Pus was removed daily by syringing, sulphanilamide powder with boric acid was insufflated, and a cotton-wool plug was inserted in the outer meatus. Any nasopharyngeal infection was treated with steam inhalations.

Results.—Ten cases were seen, all unilateral. All resolved with treatment and the hearing was restored to its previous level.

Chronic Suppurative Otitis Media

Definition of Terms Employed.—Consideration of the history allowed of the division of the cases into two groups according to the continuity of the otorrhoea. If this has been without break since the onset of the disease the condition may be termed "continual," whereas if the otorrhoea ceases and the middle ear becomes dry, only to relapse at a later date, the condition may be termed "recurrent." Accurate placing of the cases into either group was not always possible in the absence of previous clinical examination. If the discharge temporarily diminishes so that evaporation will suffice to prevent it emerging from the entrance of the external meatus the patient may conclude that the ear is dry when such is not the case. For the purposes of classification used in this paper those cases of middle-ear disease where the otorrhoea ceases for periods of less than one month were placed in the "continual" group, and those with a dry ear for periods of more than one month were placed in the "recurrent" group. The classification is based on the supposition that an ear subject to recurrent attacks of infection will be more likely to become dry with treatment than the ear from which the discharge has been continual. This grouping has been found of value as a simple aid for the determination of the severity of the disease and the reaction to treatment. It is realized that the classification is not a completely accurate diagnostic criterion. Certain cases placed in the "recurrent" group will, for the reason stated above, belong to the "continual" group, though the opposite is unlikely to occur.

The results of treatment have been classified under the heads of "cure," "quiescence," and "failure."

The criteria held to be necessary for a case to be regarded as cured vary according to the previous history. In the "recurrent" case with previous attacks of short duration the "present" attack was regarded as cured when observation after a minimum period of one week without treatment disclosed the middle ear to be dry on inspection and by mopping with a fine wool-tipped probe through the perforation. In the other type of "recurrent" case, where previous attacks had been few and possibly the "present" attack had been of long duration, the same criteria were used if during treatment there

had been a steady decline in the amount and improvement in the nature of the discharge. "Continual" cases were regarded as cured when the middle ear was dry for a minimum period of two weeks without treatment. In some cases it was possible to examine the ear at intervals up to a year after cure, but, while it is desirable to do this in all cases, circumstances outside the control of this investigation have made this impossible.

It is considered that the inclusion of certain cases under the heading of "quiescent" is justified from the administrative aspects of an ear-treatment service. Cases have been placed in this group when, despite prolonged and adequate treatment and subsequent weekly or monthly observation, the middle ear only remained moist but pus did not flow through the perforation. The less severe cases merely required inspection and toilet at monthly or longer intervals. The more severe cases required frequent inspection and toilet. Without this regular treatment the infection may become more severe, with the production of pus appearing at the meatus in the form of either an acute exacerbation or a gradual recrudescence.

Treatment was regarded as failing if, after an adequate course of at least four to six months, pus was found in the external meatus within 24 or 48 hours after the last treatment. Except in 16 cases where no lessening of the discharge occurred, treatment resulted in diminution of offensive odour and the amount of the discharge; this appeared to be the reason for the persistence with which the patients attended over long periods. In this group were many cases in which the hearing was such that an increase of the deafness would be expected if surgical procedures were resorted to.

For the purposes of description the positions of a perforation will be described under certain groups. The diagrams show the relation to the principal landmarks of the ear-drum.

Alterations in the size and shape of the perforation have been observed during the course of treatment but are without prognostic significance. Migration of the perforation has been seen in a few cases, but not to a degree sufficient to alter the original designation.

Double perforations fall into two varieties. In one, both perforations are in the membrana tensa, usually in front of and behind the handle of the malleus, and are classified as "central." In the other variety one perforation is in the membrana tensa, the other in the membrana flaccida. In all the examples seen of the latter variety the superior perforation has shown the greater activity and the case has been classified as "superior."

Aetiology.—Age of onset. Table V shows the age at the onset of the first attack of otitis media where a reliable history could be obtained. It will be noticed that 44.4% of the patients

TABLE V.—Chronic Suppurative Otitis Media. Age at Onset of First Attack

Age:	0-5	6-10	11-20	21-30	31-40	41-50	51-60	Over 60	Total
No. of patients	78	38	61	49	23	9	2	1	261
Percentage distrib.	29.9	14.5	23.3	18.7	8.8	3.4	0.7	0.3	100

experienced their first attack in the first decade of life. Thereafter there is a steady decline with each decade. It is probable

that some patients, having no recollection of otitis media in childhood, gave a later date and have caused the incidence in later decades to be too high.

Evidence has been found in the cases treated that the removal of the factors leading to chronicity is often feasible and will result in the cessation of the otorrhoea. That chronicity may be due to one factor alone has been shown by individual cases in which the otorrhoea had been present for over six months. Thus prevention of stagnation of the discharge due to inefficient treatment allowing of its accumulation resulted in a dry ear in 77% of the successfully treated ears. The removal of cholesteatoma present in the middle ear led to a dry ear in 1.7% of the successfully treated ears, and of granulation tissue or polypi in 2.25% of those successfully treated. Two or more factors were commonly present in the one case, such as stagnation and granulation tissue, and it was not until both causes had been removed that a cure resulted. In certain cases circumstances led to the removal of one factor before the other, and the result justified the above conclusion. It is accepted that necrosis of bone in the middle-ear cleft and infection of the mastoid antrum and air cells are factors causing chronicity, but the facilities at the disposal of this investigation did not enable corroboration of this to be obtained.

Chronic suppuration of the nasal sinuses was held to be the cause of chronicity in 8, chronic infection of the tonsils in 19, and chronic infection of the adenoids in 6 patients.

Ascending infection from the Eustachian tube was common, and an acute respiratory infection was a frequent cause in many cases of recurrent attacks of otitis media. The middle ear remained infected until the nasal and pharyngeal infection had subsided. It was noted that when the middle ear was already infected the supervention of an acute respiratory infection caused an increase in the amount of the otorrhoea in all cases with an anterior or central perforation of the ear-drum, occasionally with a postero-central perforation, and rarely with a superior or postero-superior perforation.

Methods of Treatment Adopted for C.S.O.M.

The elimination of infection in the nose, mouth, or pharynx causing an ascending spread via the Eustachian tube was considered to be an essential part of the treatment of chronic suppurative otitis media. The method of removal of the pus from the ear has been conditioned by the nursing facilities in the factory medical departments. It is admitted that syringing may transfer bacteria from the skin of the outer meatus into the middle ear and that mopping with a dry cotton-wool-tipped probe under direct vision through an aural speculum will reduce this mode of infection. The latter form of treatment, however, requires skilled personnel to attain thorough and painless removal of the pus. The lack of previous experience of conservative ear treatment, the changes of nurses on a duty rota, and the small numbers of patients treated have prevented the attainment of this skill. As a matter of expediency, syringing has therefore been adopted in most cases. Exceptions were made in some of the cases with associated otitis externa, where it was thought that the introduction of water would exacerbate or delay the resolution of the meatal condition, and those cases where syringing even with water carefully adjusted to the body temperature caused objectionable vertigo. In these latter cases the progress of the middle-ear condition has been slower. Deficiencies in the adopted method of daily treatment have to some extent been made up by a thorough cleansing of the meatus and middle ear under direct vision by the otologist at weekly intervals.

The choice of medicament used after cleansing the middle ear has been determined by the requirements of the case and the previous experience of the otologist. No new preparations have been employed. The ones chosen have been employed because the results from their use are already known and not because it is considered that other medicaments are of less value.

Where there was profuse discharge, epithelial debris, granulation tissue, or cholesteatoma, drops of surgical spirit 50% in water were employed with the aim of effecting greater penetration of the exudate. It was considered that a dry powder would either be rapidly washed out by the discharge or remain on the surface of the debris or granulations. Where the discharge

was moderate or scanty, and particularly in those cases with a large central perforation, insufflations of powder were chosen. Equal parts of sulphanilamide powder and boric acid gave satisfactory results except in those cases, mentioned in a previous section, where a local reaction of the meatal skin occurred. In such cases a change to spirit drops or iodine and boric powder was generally sufficient to cure the meatal condition.

The frequency of treatment of the individual case was mainly determined by the amount of the discharge. Daily treatment was given when pus was present in the meatus, and was discontinued when the middle ear kept dry for at least twenty-four hours without attention. In certain cases where no offensive odour was present daily treatment was discontinued when it had been carried out for at least two months and the discharge had become so scanty that on two consecutive weekly examinations the pus was visible only on a wool-tipped probe after mopping through the perforation. The patient was then seen at weekly intervals, and if the quantity of the discharge increased a return was made to daily treatment. If all was well the ear was regarded as quiescent.

Quiescent ears were examined at weekly, monthly, or longer intervals according to the amount of pus present at each visit and the length of time since daily treatment had been discontinued. Any epithelial debris, wax, or bead of pus in the middle ear was removed, and if necessary the middle ear was flushed out with warm spirit, using an attic syringe. The ear was then dried with wool-tipped probes and lightly dusted with powder.

Granulation tissue and polypi were not treated until the ear had had one or two weeks' daily treatment. It was considered that an effort should first be made to reduce the amount of infection and allow for the shrinkage of inflamed mucous membrane. Sessile granulations were touched with a concentrated solution of trichloroacetic acid on a fine wool-tipped probe, or, when a more penetrating action was desired, with a bead of chromic acid fused on to the tip of a fine straight or bent metal probe. Larger granulations were removed with cup forceps and the stump treated with one of the above-mentioned escharotics. Polypi were removed with an aural cutting snare or cup forceps after preliminary analgesia induced by 20% cocaine solution applied sparingly on pledgets of cotton-wool packed round the pedicle. Care was taken in cases where granulations or polypi arose from the inner wall of the middle ear or from the upper part of the posterior wall of the middle ear in proximity to the facial nerve.

Cholesteatoma in the middle ear was removed by the use of an attic syringe, bent probes, or forceps, after preliminary shrinking with spirit.

The reintroduction of infection via the external auditory meatus was diminished by stressing the importance of this route to the patient.

Results of Treatment of Chronic Suppurative Otitis Media

In presenting the results it has been necessary to allow for the high proportion of patients who did not continue treatment until the effect could be assessed. Out of 274 patients seen with chronic suppurative otitis media 39 attended for less than one week's treatment and 58 cases defaulted after longer periods of treatment. Six patients were still under treatment when the results were assessed.

Cases defaulting after less than one week's treatment can be disregarded, as can those still under treatment. It is not possible to ignore the third group. The incompletely treated group of cases having at least one week's treatment will consist of those patients who, as confirmed occasionally by subsequent examinations, rightly concluded that the ear was dry and did not return for final examination, and those patients with an ear condition not amenable to even a prolonged course of conservative treatment. To assess the results solely on these cases adequately treated would leave out of account an unknown quantity of considerable size. The figures presented (see Table VI) therefore represent the minima or maxima as the case may be.

TABLE VI.—*Chronic Suppurative Otitis Media. Results of Treatment*

	No. Seen	No. Where Treatment Completed	No. Where Treatment Completed + No. Partially Treated	No. Cured	% of Fully Treated Cases Cured	% of All Treated Cases Cured
Patients with unilateral disease	232	161	199	135	83.8	67.8
Patients with bilateral disease	42	26	36	14	53.8	38.8
Number of ears	316	213	271	173	81.2	63.8

It will be seen that out of 232 patients with unilateral disease 199 received one or more weeks' treatment and 161 had a full course of treatment. At its termination 135 were dry. This gives an "immediate" cure rate of 67.8% for patients receiving one or more weeks' treatment, or 83.8% for patients receiving adequate treatment. As already explained, the true cure rate will lie somewhere between these two percentages.

Of 42 patients with bilateral ear disease 36 received one or more weeks' treatment and 26 a full course of treatment. In 14 patients both ears were dry at the end of treatment, giving an "immediate" cure rate of between 38.8% and 53.8%. Of a further 10 patients in whom one ear became dry as a result of treatment the other ear was rendered quiescent in 6 and the remaining 4 ceased attending.

The average duration of treatment for the cured cases was 5.2 weeks (limits, 1 week to 7 months).

Table VII shows the duration of the otorrhoea in 276 ears. The "recurrent" ears are shown separately from the "continual" ears. It will be seen that 84% of the "recurrent" ears

TABLE VII.—*Chronic Suppurative Otitis Media. Duration of Otorrhoea and Results of Treatment*

	Less than 6 Months		6 Months to 1 Year		1 to 5 Years		Over 5 Years		Total
	Rec.	Cont.	Rec.	Cont.	Rec.	Cont.	Rec.	Cont.	
No. of ears	101	20	6	6	12	26	2	103	
Total	121 (44%)		12 (4%)		38 (14%)		105 (38%)		276 (100%)

had been discharging for less than six months and 66% of the "continual" ears for more than five years. More than half of these ears had been discharging for more than one year.

In Table VIII 247 ears are classified according to the intermittency or otherwise of the discharge. Excluded from the table are 25 "continual" ears in which the duration of the discharge could not be determined.

TABLE VIII.—*Chronic Suppurative Otitis Media. Results of Treatment in "Recurrent" and "Continual" Cases*

Duration of Discharge:	"Recurrent" Ears	"Continual" Ears				
		Less than 6 Months	6 Months to 1 Yr.	1 to 5 Years	Over 5 Years	Total
Ears treated	112	17	5	23	90	135
Ears cured	92 (83%)	11 (65%)	4 (80%)	10 (43%)	43 (48%)	68 (50.4%)
Ears quiescent	5 (4.5%)	1 (5%)	0	1 (4.3%)	10 (11%)	12 (8.9%)
Ears failed	0 —	1	1	6	8	16 (11.8%)

Despite the high proportion of patients not completing treatment, 83% of the "recurrent" ears were treated with success in an average period of four weeks, while only 50% of the "continual" ears responded in an average period of 6.7 weeks.

There was no relation between the duration of the disease and the length of treatment necessary to effect a cure.

The "recurrent" group does not contain any failures, and the ears rendered quiescent are only half as frequent as those in the "continual" group. In the latter group it would appear that otorrhoea lasting longer than one year carries a worse prognosis for successful conservative treatment.

Marginal and superior perforations were found to occur most frequently in the "continual" cases and were rare in the "recurrent" cases.

A total of 90 ears were seen in which granulation tissue or a polypus arising from the middle ear or tympanic membrane was present. Of these, 55 showed granulation tissue and 35 showed polypi. The total figure represents 28.8% of all ears with chronic suppurative otitis media examined.

Of the "recurrent" ears treated, 19.3% had granulation tissue, compared with 35.5% of the "continual" ears. As a result of treatment it was found that there was a slight worsening of the prognosis when granulation tissue was present in the ear, but the better prognosis of the "recurrent" over the "continual" case was again observed. If the granulation tissue arose from the tympanic membrane or external auditory meatal walls only slight reduction of the cure rate resulted, but where the site of origin was from the tympanic ring or the middle ear the prognosis was much worse.

Six cases of cholesteatoma of the middle ear were seen. In three patients a dry ear was obtained.

Relation between Hearing, Clinical Condition, and Effects of Treatment

Long duration of the disease since the first onset was not found to be necessarily associated with poor hearing, although severe deafness was relatively more common with cases of longer than five years' duration than with those of less than one year's duration.

The site of the perforation in the tympanic membrane was not related to the degree of hearing loss. Similarly, the possession of good hearing at the outset of treatment did not necessarily imply a good response to treatment, nor did the reverse hold true.

Table IX, in graphic form, shows the change in hearing as a result of treatment. The values marked along the abscissa

TABLE IX.—*Chronic Suppurative Otitis Media. Improvement in Hearing as a Result of Treatment*

NOTE.—Hearing groups are: (1) Whisper 0-2 ft.; (2) whisper 2-5 ft.; (3) whisper 5-10 ft.; (4) whisper 10-20 ft.; (5) whisper over 20 ft.

record the change in hearing according to the number of hearing groups. Thus, if an ear when first seen could hear a forced whisper at a distance of three feet, and at the end of treatment a forced whisper could be heard at a distance of 18 feet, the improvement in hearing is recorded as two groups. When the hearing improved only from, say, an ability to hear a forced whisper at a distance of three feet before treatment to five feet after treatment, the improvement is recorded as half a group. Ears showing deterioration of hearing are recorded on the left of the ordinate. The resulting curves show that in many ears the hearing is unchanged as a result of treatment, but that the

hearing in the remainder was more often improved than worsened. Further, the upper curve shows that even when treatment did not result in a dry ear, or was discontinued before completion, some improvement in hearing resulted, although the left-hand half of the curve shows that deterioration was more common.

Recurrence of Otorrhoea After Successful Treatment

To obtain an estimate of the proportion of cases in which a relapse of infection occurred after treatment a postal questionnaire was sent to the patient after an interval varying from six to eighteen months. Replies were received from 65% of the total number questioned, and of these 27 attended for examination by the otologist. In addition 28 patients were examined at least six months after their last treatment.

Thus out of 235 patients 53 were examined by the otologist and 63 sent a report on their condition six to eighteen months after the termination of treatment.

The results of this follow-up are shown in Table X. The term "immediate" cure is applied when the ear is dry at the end of treatment and "prolonged" cure when the ear has remained dry for at least six months after the end of treatment.

TABLE X.—*Chronic Suppurative Otitis Media. Reinfection after Treatment*

	Examined by Otologist		Report from Patients	
	Unilat.	Bilat.	Unilat.	Bilat.
"Immediate" cure	37	3	42	2
"Prolonged" cure	20 (54%)	1 (33%)	29 (69%)	2
Relapse	17 (46%)	2	13 (31%)	—
"Immediate" quiescence	6	1	1	—
"Prolonged" cure	2	—	—	—
Still quiescent	4	1	1	—
Failure. (<i>In statu quo</i>)	1	—	1	—
Defaulted before treatment completed	5	—	15	2
"Prolonged" cure	1	—	4	—
<i>In statu quo</i>	4	—	11	2

Of the patients examined by the otologist it will be seen that of 37 "immediate" cures in unilateral cases 54% were "prolonged" and of 3 bilateral "immediate" cures in both ears only one was "prolonged." Of 6 unilateral and 1 bilateral cases "immediately" quiescent 2 unilateral cases subsequently became dry. Four unilateral and the one bilateral case were still in the same condition six or more months later.

Similarly, of the cases reported by the patients, 69% of the unilateral and both of the bilateral cases were said to be "prolonged" cures.

Examinations of patients suffering from chronic suppurative otitis media occasionally showed abnormal conditions in the opposite ear. Table XI summarizes the findings and shows the percentage incidence of the total number of patients examined (274). Of these patients 50.3% had evidence of past or present suppuration in the opposite ear.

TABLE XI.—*Chronic Suppurative Otitis Media. Conditions Present in Opposite Ear*

	No.	Percentage
Chronic suppurative otitis media (e.g., bilateral disease)	42	15.3
Healed otitis media	80	29.2
Healed cortical mastoidectomy	6	2
Healed radical mastoidectomy	10	3.6
Total	138	50.3% of 274 patients

Associated otitis externa was found in the affected ear in 17 cases of chronic suppurative otitis media.

In the whole series of cases a positive fistula sign was discovered in 2 cases, vertigo from labyrinthine irritation in 2 cases, and suspected intracranial complication in 2 cases.

Cases requiring surgical treatment may be considered under two heads. Those of relative urgency were two in number. Both exhibited a positive fistula sign. The other cases belong to the group in which conservative treatment failed and where surgical treatment would be one of convenience. In more than

half of these the hearing was of sufficient acuity to suggest the choice of an operation designed to preserve the residual hearing rather than the full radical operation.

Healed Otitis Media

The cases grouped under the term "healed" otitis media are those in which the ear-drum shows scars or perforations with no evidence of active infection such as pus, redness, or dilatation of the blood vessels. Those ears which are subject to recurrent attacks of inflammation and happen to be examined during a quiet phase will be included in this group. If the ear was initially examined during the quiet phase, and was later seen with a recurrence of inflammation, it has been placed in the group of recurrent chronic suppurative otitis media. Cases in which a mastoid operation had been performed are dealt with under a separate heading.

A total of 249 patients have been observed, of which 96 were right-sided, 78 left-sided, and 75 bilateral. In 32 cases there was a history of recurrent attacks of otorrhoea and of an attack within the previous five years.

Table XII shows the age at which the first attack occurred in those cases in which a history could be obtained. It will be seen that 57% of the patients stated that the initial attack occurred in the first decade of life.

TABLE XII.—Healed Otitis Media. Age at Onset

Age:	0-5	6-10	11-20	21-30	31-40	41-50	51-60	Over 60	Total
No. of patients	57	29	26	19	16	4	1	1	153
Percentage distrib.	37.3	19.0	17.0	12.5	10.5	2.5	0.6	0.6	100%

When the initial attack occurred more than 20 years previously 38% of the ears had a severe hearing loss (whisper heard at a distance of less than 5 feet) and only 51% had moderate or good hearing (whisper heard at more than 10 feet distance). By contrast, when the initial attack occurred within the previous 5 years only 10% had a severe hearing loss and 83% had moderate or good hearing. This indicates that progressive deafness will result from a healed infection.

Healed Cortical Mastoidectomy

A total of 28 ears have been seen, in which the disease was right-sided in 12, left-sided in 12, and bilateral in two. The age at the time of operation is shown in Table XIII.

TABLE XIII.—Healed Cortical Mastoidectomy. Age at Operation

Age:	0-5	6-10	11-20	21-30
Number of ears	3	10	13	2

Out of these 28 ears, 14 were found to have infection of the middle ear. In two the pus was coming from the attic region. One case of facial palsy due to the operation was observed. Of 10 ears receiving adequate conservative treatment on the lines detailed under "chronic suppurative otitis media" nine responded with cessation of the discharge, the average duration of treatment being 7.1 weeks. The other four ears with infection of the middle ear ceased attending for treatment before the result could be ascertained.

Table XIV shows the hearing recorded according to the state of the middle ear and the condition of the tympanic membrane. The presence or absence of infection in the middle ear does not appear to have any relation to the hearing in the small number of cases seen.

TABLE XIV.—Healed Cortical Mastoidectomy. Hearing Loss

	Middle Ear Dry, Drum Intact	Middle Ear Infected
Forced whisper heard 0-2 ft.	4	3
" " " 3-5 ft.	—	1
" " " 6-10 ft.	2	2
" " " 11-20 ft.	2	6
" " " over 20 ft.	6	2

Healed Radical Mastoidectomy

A total of 49 ears were seen, in five cases bilateral. Among these cases were five operated on by the transmeatal route and in six a modified operation had been performed with

preservation of the tympanic annulus. In 24 ears the cavity was infected from the Eustachian tube. Four cases of facial palsy due to the operation were observed.

Table XV shows the duration of otorrhoea before the operation had been performed and the degree of deafness at the time of examination. Nearly two-thirds of the ears had had the

TABLE XV.—Healed Radical Mastoidectomy. Hearing Loss and Duration of Otorrhoea before Operation

	Hearing Loss	Duration of Otorrhoea Before Operation				
		0-5	6-10	11-20	Over 20 Years	Duration not Known
No. of ears	49	8 (35%)	7 (29%)	5 (22%)	3 (13%)	26
Severe perceptive deafness	8					
Forced whisper heard 0-2 ft.	24					
Forced whisper heard 3-5 ft.	6					
Forced whisper heard 6-10 ft.	2					
Forced whisper heard 11-20 ft.	9					

operation within 10 years of the first onset of the otorrhoea. Despite this, 77% of the ears were severely deafened (forced whisper heard at five feet distance or less), indicating the serious effect on hearing of severe ear disease and the failure of the radical mastoidectomy operation to restore a useful degree of hearing.

Eustachian Obstruction

In 65 patients 96 ears were seen, of which 31 cases were bilateral and 34 unilateral. In 63 ears the condition had been present for less than two months; in the remainder the condition had been present for more than two months. In 33 ears the onset was associated with an acute upper respiratory infection. In two bilateral cases the middle ear of one side contained serous fluid, as shown by a fluid level and severe deafness. Both cases resolved with treatment.

Of these ears 41 were treated by inflation with Politzer's bag or a catheter, and all except five of the patients stated at its conclusion that the hearing had been restored to the previous level. Corroboration of their statements was not possible in all cases, as associated healed otitis media or perceptive deafness was present in some.

Clinical Otosclerosis

The ultimate diagnosis of otosclerosis depends on the demonstration by histological methods of the specific pathological lesion in the labyrinthine capsule. It is known that other conditions may give rise to clinical findings closely resembling true otosclerosis. In the absence of an exact dividing-line acceptable to all shades of otological opinion the term "otosclerosis" has in this work been qualified by the prefix "clinical." Furthermore, it is necessary to mention the principles which have been adopted in diagnosis.

The deafness is bilateral, but may be more pronounced in one ear. Its onset must be between the ages of puberty and 30 and the course slowly progressive. The upper age limit has not been exactly adhered to if there appeared to be a reasonable doubt about the age at onset. Several patients, while denying any hearing loss before the age of 30, admitted that their hearing was then not so acute as other people's. In conformity with the view that the condition is inherited, but with a recessive characteristic, a history of the disease in blood relations is not held to be essential, but its presence adds confirmation. A history of otitis media or thickening, scarring, or perforation of the tympanic membrane has excluded the case from the diagnosis of otosclerosis, though there is no reason why the two conditions should not exist in the same individual. The absence of pathognomonic changes in the tympanic membrane has, as with the family history, been regarded as confirmatory but not essential. Tuning-fork tests show the deafness to be of the conductive type, but concomitant perceptive deafness is counted as additional evidence. Finally no more than a slight and short-lived improvement in the hearing results from instrumental Eustachian inflation.

A total of 26 cases of clinical otosclerosis have been examined. A family history was obtained in 10 (38%). The average

age at which the deafness was first noticed was 22.5 years. In 14 (54%) a demonstrable degree of perceptive deafness was found with tuning-fork tests. Table XVI shows the hearing in the cases.

TABLE XVI.—*Clinical Otosclerosis. Results of Hearing Tests*

	Better Ear	Worse Ear
Forced whisper heard 0-2 ft.	22	24
" " " 3-5 ft.	4	2
" " " over 5 ft.	—	—

Conductive and Mixed (Conductive and Perceptive) Deafness of Unknown Aetiology

The cases placed in this category gave no history of previous inflammatory ear disease and the tympanic membranes were normal. No improvement resulted from instrumental Eustachian inflation. They have not been considered under the section on clinical otosclerosis because the age at which the deafness was first noticed was before puberty or well after the age of 30, or the onset of the deafness was of too recent an origin to judge whether spontaneous improvement would occur. It is possible that many of these cases are due to inflammatory adhesive processes in the middle-ear cleft, but no positive evidence for this could be found. A total of 7 cases of conductive and 13 cases of mixed deafness were encountered.

Perceptive Deafness

The cases considered in this section include those with perceptive loss of hearing as the sole cause of deafness and those in which, in addition, the deafness was partly due to lesions in the conductive mechanism of known aetiology. The exceptions are cases due to clinical otosclerosis and mixed deafness of unknown aetiology. A total of 117 cases were seen, and Table XVII shows the associated lesions or the conditions of possible aetiological significance present at the onset of the deafness.

TABLE XVII.—*Perceptive Deafness. Associated Lesions, or Conditions Present at Onset*

Chronic suppurative otitis media	6
Healed otitis media	32
Healed cortical mastoidectomy	1
Healed radical mastoidectomy	6
Industrial noise	8
Artillery and other forms of explosives	22
Toxic auditory neuritis	1
Meningitis	1
Arteriosclerosis	2
Concussion or fracture of base of skull	7
Post-influenzal	2
Post-operative	2
Pre-parturition	1
Congenital syphilis	1

In 57 patients no cause for the deafness was discovered, and the age of onset of this latter group of cases is shown in Table XVIII.

TABLE XVIII.—*Perceptive Deafness. Age at Onset of Cases with Unknown Aetiology*

	0-10	11-20	21-30	31-40	41-50	51-60	Over 60	Total
No. of patients	2	3	4	4	19	15	10	57
Percentage	3.5%	5%	7%	7%	33%	26%	18%	—

It will be noticed that there is a sudden rise in the incidence during the fifth decade of life. The number of fresh cases occurring during the next two decades tends to fall.

Other Conditions of the Ear not already Classified

Little comment is called for on these cases, which are shown in Table XIX. The cases of Ménière's disease were confirmed by abnormal responses to calorie tests.

TABLE XIX.—*Other Ear Conditions not already Classified*

Tinnitus as sole symptom	4
Ménière's disease	7
Vertigo from causes other than Ménière's disease	11
Referred otalgia from lesions of nose, mouth, and pharynx	6
Traumatic perforations of tympanic membrane; not infected	3
Positional vertigo	1

Conditions of Nose and Throat

The conditions mentioned in Table XX occurred in patients who consulted their industrial medical officer in preference to their own medical practitioner or local hospital. In many

instances the symptoms were considered by the patient to have been caused by his work. In most cases the patient had recently come to live in the district and was not familiar with the local non-industrial medical services.

TABLE XX.—*Conditions of Nose and Throat*

Nose:	
Vasomotor rhinitis	14
Chronic rhinitis	8
Vestibulitis	3
Epistaxis	1
Deviation of nasal septum	3
Nasal polypus	13
Nasal sinusitis	8
Throat:	
Acute pharyngitis and tonsillitis	5
Chronic pharyngitis	2
Chronic tonsillitis	9
Chronic catarrhal laryngitis	5
Fibroma of larynx	1
Tuberculous laryngitis	1
Nasopharyngeal carcinoma	1
Post-cricoid carcinoma	1
Unclassified	3

The case of tuberculous laryngitis occurred in a woman aged 22 whose chest was said to have been radiologically normal three months previously. There is no doubt that this woman was sent away for proper treatment at an earlier date than she would have been if a visiting specialist had not been readily accessible at the factory.

Table XXI lists the examinations conducted for suspected disease of the ear, nose, or throat where nothing abnormal was discovered. It may be noted that, with the exception of the

TABLE XXI.—*Suspected Disease of Ear, Nose, or Throat. Nothing Abnormal Found*

Otalgia	19
Symptomatic deafness	20
Symptomatic otorrhoea	10
Suspected ear, nose, or throat disease acting as a focus of sepsis	9
Suspected retained pharyngeal or oesophageal foreign body	4

cases examined for suspected focal sepsis, these patients would rarely be seen in hospital practice, although they are only too familiar to the general practitioner.

A further 24 patients were found on examination to have miscellaneous conditions of other parts of the head or neck.

General Observations on the Clinical Results

The results of ear disease in the majority of cases are not dangerous to life but will cause varying degrees of disability. In severe cases a fatal termination or a temporary or permanent loss of wage-earning capacity may ensue. In the less severe cases there will be an interference with the general well-being and activities of the individual. The loss of efficiency resulting from pain or deafness will depend on the severity and duration of the symptoms, and to some extent on the type of work in which the sufferer is engaged. It will be of value, therefore, to examine the clinical material presented here from this aspect.

Out of the total of 274 individuals found to have chronic suppurative otitis media only two were suffering from a form of the disease in which surgical treatment was considered urgent and in which the risks of neglect would endanger life. In a further 16 individuals conservative treatment had failed and a surgical operation was necessary as a matter of convenience to prevent development of dangerous complications. Thus surgery, immediate or delayed, was necessary in only 9% of the total of 187 receiving treatment.

The major cause of loss of working efficiency was pain. The degree of pain was greatest and of the longest duration with inflammatory conditions of the pinna and external auditory meatus. Infection of the middle ear rarely caused pain, and when it did it was of short duration and not usually of great severity. The frequency of otitis externa and the duration of the treatment made this condition of major importance in the organization of the factory ear-treatment service. Although the permanent effects did not give rise to the same disability as those following otitis

media, the liability to recurrence of the attacks caused in the aggregate a considerable degree of loss of efficiency.

The effect of deafness on the daily life of the sufferer was noticeable in several ways. Where there had been a sudden diminution of hearing, as from an occluding plug of cerumen, acute otitis media, or an increase in the rate of progress of a progressive deafness, the patient was continually conscious of this disability, and this preoccupation caused interference with the capacity for work. On the other hand, a progressive deafness increasing at a slow, even rate was better tolerated and its severity was often not fully appreciated. Psychological adaptation to deafness was rarely judged to be complete. In the essentially communal nature of work in the factory the sufferer felt the gulf dividing him from his fellows, and this affected the contentment of his outlook on life. The direct effect of deafness on the efficiency of his work varied with his job. In the majority of cases good hearing was not essential. The general level of factory noise may often be such that conversation can be carried on only with a raised voice. If the threshold of hearing of the deafness is less than the factory noise no disability will result. It is only with certain processes carried out in quiet workrooms that good hearing may be an advantage, but it is seldom a necessity. For supervisors or clerical workers, however, the possession of fair hearing is usually important, and a deaf worker would thus find his chances of promotion curtailed. A few cases of intolerance to excessive noise have been observed, and, although this may occasionally have been a psychological "escape" reaction from monotonous work, it necessitated the individual being moved to another job in quiet surroundings. There his lack of experience may have rendered him less efficient at the work.

Working efficiency can be affected by the home life and activities outside the factory. A sense of physical inferiority induced by the deafness may exist, and even if the disability is only apparent in social intercourse the mental stress so caused may affect the relations with friends. Hence, while pain can cause a marked but short-lived loss of working power, incurable deafness, although less crippling in any one individual, may, because of its much greater incidence, be an equally important cause of loss of efficiency in the working population.

The deafness resulting from the various types of disease has already been mentioned under the appropriate sections. Out of 393 cases of severe deafness (forced whisper heard at less than 5 feet distance) due to all types of disease, 49.3%, or nearly half, were due to active or healed otitis media. Cases of otitis media associated with perceptive deafness (19%) are not included in this group.

The correct management of otitis media in the early stages, before the onset of incurable deafness, is therefore of importance. As the onset most often occurs in childhood (Tables V and XII) general-practitioner and school-treatment services are responsible for the treatment. That these services are inadequate is shown by the survey conducted among factory workers, where 3.3% were found to be suffering from chronic suppurative otitis media.

It has been shown in Table VI that treatment carried out in a factory medical department will result in a dry ear in 67% to 83% of the patients with unilateral otitis media and 38% to 53% of those with bilateral otitis media (both ears dry). From 5% to 6% of patients with unilateral ear disease will obtain a quiescent ear with such treatment. (Precise figures for the cure rates cannot be given, for the reasons stated previously.) Examination at a later date will show that more than half of the ears initially dry after treatment will relapse (see Table X), although a further course of treatment will be successful

in most cases. The ears rendered quiescent by treatment stand a good chance of remaining in this state with an occasional toilet, and some may eventually become dry.

If, therefore, 100 patients with unilateral chronic suppurative otitis media are given a full course of conservative treatment in a factory medical department it can be surmised from the results obtained in this investigation that 38 will have a dry ear for at least six months, 45 will have a dry ear at the termination of treatment but will relapse in under six months (although standing a good chance of cure with subsequent treatment), 6 will be rendered quiescent, and 11 will need a surgical operation.

It is thus apparent that conservative treatment will result in cessation of the infection in a high proportion of cases, but the liability of the treated ear to reinfection indicates the deficiencies in this form of treatment and the poor prospect of obtaining a lifelong cure. The conservative treatment of relapses as they occur has the advantage of retaining a greater degree of hearing than treatment by a surgical operation. But even when the latter method is employed occasional treatment will subsequently be necessary.

The Future Expansion of Factory Otolological Treatment

The results of treatment obtained in the factory medical department are not as successful as those carried out under ideal conditions, but they compare favourably with those obtained in the average hospital otological out-patient department. The present investigation has been of short duration and therefore temporary. It can reasonably be expected that if a permanent service were to be set up the larger numbers dealt with and the greater dexterity of the nursing staff would improve the results of treatment. For cases requiring daily treatment, interruption at week-ends and at public holidays delays or prevents healing and is a drawback to any scheme of factory treatment that may be considered. But for most cases factory treatment is adequate and has the overriding advantage of ready accessibility to the sufferer.

The present overloading of hospital facilities would be eased by a factory ear-treatment service which by a dissemination of otological knowledge would act as a screen for the less serious cases and by prevention reduce the incidence of serious complications.

With the present shortage of trained otologists it is essential that the fullest use should be made of their time. It is necessary, therefore, that factory clinics should be large enough to justify the time spent by the otologist in travelling to the factory. From experience gained in the present investigation it is probable that a unit employing 5,000 persons would provide enough cases to justify the organization of a treatment service, and that a unit of 15,000 persons would require the services of an otologist for three hours once a week. Daily treatments arising in larger units would take a nurse from one to two hours each day to perform. Any permanent scheme could be satisfactorily conducted by a medical practitioner sufficiently skilled in otology to reach "registrar" status, or by one who has had the equivalent of two years' whole-time experience in otolaryngology. It would be desirable for him to be based on or have a close liaison with the ear department of the local hospital (such as a clinical assistantship), so that unusual cases could be referred there for fuller investigation and the opinion of the consultant.

Single factories employing large numbers of individuals are unusual in Great Britain, but industrial medical officers are of the opinion that it would be feasible to organize a treatment service based on a small factory which could treat the employees of other factories in the near district. Each

manufacturing area would present its own problems of organization, but in a congested area such as Birmingham a considerable proportion of the factory population could be included.

The prevention of deafness is an important factor in the nation's health. An ear-treatment service based on the factory is a feasible method, causing the minimum interference with the productive capacity, of arranging treatment for a part of that section of the community of great importance to the economic wealth of the country.

Summary

Chronic ear diseases, in particular chronic suppurative otitis media, are potent causes of inefficiency, invalidism, or early death. Experience during the 1939-45 war showed that disease of the ear was a serious cause of wastage of man-power. The high incidence of this disease is largely due to inefficient treatment resulting from the absence of an ear-treatment service adapted to the economic needs of the population.

Before and during the last war many industrial concerns set up medical departments to safeguard the health of the employees and to treat minor injuries sustained at work. This report gives an account of otological work carried out in seven factory medical departments over a period of eighteen months, with the object of ascertaining (a) the incidence of suppurative otitis media in factory workers and (b) the results of treatment of ear disease in the factory medical department.

To determine the incidence of ear disease in the factory population 1,902 employees, selected at random, were examined. Of these, 3.3% were found to be suffering from suppurative in the middle ear and 17.8% had active or healed middle-ear disease.

A total of 1,711 patients complaining of ear, nose, or throat symptoms were examined at clinics set up in the factory medical department: 389 were found to be suffering from disease of the pinna and external auditory meatus, and 274 from chronic suppurative otitis media. The effect of otitis media in the causation of deafness and the results of treatment are considered in detail.

From the results of treatment it is deduced that, if 100 patients with unilateral chronic suppurative otitis media receive a full course of conservative treatment in a factory medical department for an average period of 5.2 weeks, 38 will have a dry ear at the end of treatment and will keep dry for at least six months after its termination, 45 will have a dry ear at the end of treatment but will relapse in less than six months (although standing a good chance of cure with subsequent treatment), 6 will be rendered quiescent, and 11 will need a surgical operation. The results show that conservative treatment will result in cessation of infection in a high proportion of cases, but the prospects of obtaining a lifelong cure are poor. It is concluded that a surgical operation does not offer an effective alternative method of treatment in all cases.

The effects of deafness and pain on the working capacity of the factory employees are discussed. It was found that in manual workers productive efficiency was affected more by pain than by deafness but that the latter may be a handicap to promotion.

The future expansion of otological treatment in factory medical departments on a permanent basis is discussed, and it is concluded that such a scheme is feasible, is adapted to the needs of the working population, and would reduce the present overloading of the hospital services.

I am indebted to Mr. Terence Cawthorne for his advice throughout the investigation; to Dr. Donald Stewart for advice on industrial medicine and for providing the link with industry; to Mr. C. S. Hallpike for help in the preparation of this paper; to the following industrial medical officers—Dr. J. G. Billington, Dr. E. H. Capel, Dr. J. G. Lawson, Dr. W. Jeaffreson Lloyd, Dr. W. A. McClennan, Dr. N. G. Marr, and Dr. A. White—for their help in the organization of an ear-treatment service; to the directors of the following organizations—Austin Motor Co., Ltd., James Booth & Co., Ltd., Birmingham Small Arms Co., Ltd., General Electric Co., Ltd., Guest, Keen, and Nettlefolds, Ltd., Imperial Chemical Industries, Ltd., and Joseph Lucas, Ltd.—for their co-operation in the investigation; and to the nursing staffs of the above-mentioned organizations for undertaking the treatment of patients.

VITAMIN D IN TREATMENT OF BOECK'S SARCOIDOSIS

BY

R. F. ROBERTSON, M.B., M.R.C.P.Ed.

Clinical Tutor in Medicine, Edinburgh Royal Infirmary

Besnier-Boeck-Schaumann's disease, commonly known as Boeck's sarcoidosis, is now recognized as a diffuse reticulo-endotheliosis with the formation of a folliculoid tissue affecting particularly the lymphoid and haemopoietic tissues. The organs most commonly involved are the lymph nodes, spleen, lung, bone marrow, liver, eyes, and, in 50% of cases, the skin.

The skin lesions, when present, tend to cause considerable disfigurement, and hence from the patient's point of view constitute the main problem of the disease, which in other respects tends to be a benign condition without pain and systemic upset, and which progresses very slowly over a number of years. The skin lesions are of two types: (1) A symmetrical granulomatous condition affecting chiefly the nose, cheeks, ears, and fingers, described by Besnier in 1889 under the name lupus pernio. (2) Multiple granulomatous swellings of varying size affecting chiefly the face and upper limbs and having a translucent appearance. To these lesions Boeck in 1897 gave the name of cutaneous sarcoids.

It is clear that the skin lesions closely resemble tuberculous lupus vulgaris. Indeed, without a skin biopsy it is often difficult or impossible to separate the two conditions.

The resemblance to tuberculosis is not confined to the skin lesions, and in recent years many writers have speculated on the possibility of sarcoidosis and tuberculosis being variants of the same disease. The following points provide good reason for such speculation: (1) The basic pathological lesion in sarcoidosis, the sarcoid follicle, consists of endothelioid cells and a zone of lymphocytes just as in the tubercle follicle. There is, however, no caseation, and the presence of tubercle bacilli cannot be demonstrated. (2) The distribution of the disease process in sarcoidosis—i.e., in the reticulo-endothelial system—is essentially the same as in tuberculosis. (3) The development of active tuberculosis is the commonest cause of death in sarcoidosis, but whether this is *post hoc* or *propter hoc* it is not possible to say.

The position has been adequately summarized by Cameron and Dawson (1946), who state that "while there is much against the idea of a tuberculous basis, notably the frequent absence of a positive Mantoux reaction, there are sufficient resemblances, clinical, radiological, and histological, to suggest a probable causal relationship." It may be that sarcoidosis is a low-grade tuberculosis of non-caseating type.

In view of the recent successful treatment of lupus vulgaris with calciferol it seemed possible that the skin lesions in sarcoidosis might react favourably to similar treatment and thus alleviate considerable aesthetic embarrassment in patients so afflicted. Care, however, was required in selecting suitable cases, since spontaneous improvement is a common phenomenon in sarcoidosis and this might be erroneously attributed to the administration of calciferol. Eventually one case was selected in which the lesions had been slowly progressing for a period of nine years and in which spontaneous improvement was not expected.

Report of Case

The patient, a single woman, came to the Royal Infirmary, Edinburgh, for the first time as an out-patient in 1938, when she was aged 43. Her past history was negative apart from a tendency to bronchitis. At that time she had a well-marked lupus pernio causing an erythematous induration of the nose,