whilst right-sided lesions produced no great change left-sided ones did so. The evidence in favour of this is very tenuous, and my own cases go directly against such a view, for the patients were equally little affected, whichever side was operated upon. It must be conceded that once a lesion on the left side begins to go back behind the limit of the association area on the left there is a likelihood of damage to the speech centres, and no doubt it is on this account that the doctrine of left frontal dominance has grown up. An analysis of clinical material by Hyland and Botterell (1937) shows no essential difference between the two lobes apart from the aphasic element, and their conclusions on frontal lobe activities appear to be similar to those expressed here.

Cause of "Frontal" Changes

If a patient, one of whose frontal areas has been removed, has no severe frontal signs afterwards, it can be assumed that it was not purely one-sided frontal damage which was the cause of his previous disabilities. This is a very important point, but it seems to be established. In searching for another explanation two suggest themselves. The first is that it is the rise in general intracranial pressure occasioned by the tumour which is the additional agent that adds volume to the local lesion by producing widespread cerebral anaemia or oedema and interferes with the irradiation of impulses, compensation, inhibition, and so forth. Many cases are on record in which mental confusion has disappeared after a plain decompression without removal of a tumour. It must be that the successful operative management of such cases, with the consequent fall in intracranial tension and better cortical vascular irrigation, allows a resumption of normal powers by the uninjured parts of the brain. Conversely, frontal signs often appear in a high-pressure case even when the tumour is not frontal in situation. Gordon Holmes (1931) has expressed the opinion that mental symptoms are often due to high pressure irrespective of the site of the lesion. This is unquestionably true, and there is little doubt that many ill patients are psychologically abnormal not only because their suffering alters their reactions, but because their cerebral functions are impaired by anaemia. High pressure alone disturbs the mental activities of a patient more than does a local frontal tumour, because it interferes with the brain more widely than the tumour itself does; on the basis of Pavlov's view of cortical function in an integrated manner this can occasion no surprise. However, in the present series, in two cases the pressure was high and the patient had a frontal tumour as well, yet frontal signs were at a minimum. It is noteworthy that in both of these the tumour was non-invasive. This brings up the second possible factor already foreshadowed, the possibility of the tumour itself inducing some of the changes. We know that tumours which involve the primary receptor or effector apparatus often stimulate those areas to produce Jacksonian, motor or visual, or very often olfactory fits. Something of the same kind may occur in the frontal lobes; there may be some excitatory factor at the nature of which we can at the moment only guess. Such an idea was put forward long ago by Dupré and Devaux, who believed that the tumour exerts a toxic influence; but there is no clear evidence of it, and I, along with A. D. Macdonald, have failed so far to find histamine in gliomas in a few trials. I believe that the general circulatory basis plays a considerable part in the production of mental and emotional changes, but I am impressed by the differences shown by patients with invasive and non-invasive lesions. It should follow that

"frontal" changes will be most pronounced when the lesion is bilateral (as in callosal tumours), or when it is invasive, or when pressure is high, or in combinations of these conditions. Moreover, it is now easier to understand the delirium of toxic conditions, general and local, and suggest new ideas in the interpretation of the various states arising out of head injuries.

It would be unwise to conclude that removal of a frontal association area will always be a benign procedure. The patients in this series were not of any considerable mental stature; their occupations were not such as would easily bring to light faults in the higher synthesis of ideas. Whilst, therefore, a considerable amount of caution must be exercised in drawing conclusions from them which would tend to the formulation of a dogma, they illustrate the more plastic conception of cortical activities current to-day. In none was the operation carried out except in the face of necessity.

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ENURESIS*

BY

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It may be said of enuresis, as Bacon said of medicine in general, that it is a subject which has been "much laboured but little advanced," for in spite of all the attention that has been devoted to it we are still very ignorant of its causes and mechanism, and largely helpless in its treatment.

For the purposes of this discussion it will be well to define enuresis as "bed-wetting," although it is true that diurnal incontinence is often present as well. On certain points we shall probably all be agreed: that enuresis should not be regarded as abnormal until the child has reached the age of 3; that it is commoner in boys than in girls; that most cases date from birth, although occasionally bladder control is lost after it has once been acquired; that it is worse in cold weather. We shall agree also, I think, that the term "enuresis" should be reserved for functional cases and that examples of incontinence associated with diabetes mellitus or insipidus, with chronic nephritis, with stone in the bladder, and with congenital lower urinary tract obstructions should be excluded, as well as incontinence occurring in cases of epilepsy or mental deficiency.

* Read in opening a discussion in the Section of Diseases of Children at the Annual Meeting of the British Medical Association, Belfast, 1937.

There may be less agreement as to the type of child likely to suffer from enuresis. Some are of opinion that it is commonest in children who are either highly excitable on the one hand or unduly phlegmatic on the other; my own experience has been that enuretics do not differ in temperament from the average.

As to the mechanism of the disorder there has been much speculation, but, broadly speaking, it may be said that the underlying defect is some failure in the neuromuscular mechanism of the bladder, so that the reflex micturition of infancy persists. Further than this very general statement I do not think one can safely go. It has been suggested that the failure is brought about by the cessation during sleep of the control exercised by the higher centres over the lower; but that surely is the case in every child, whether an enuretic or not.

Various contributory conditions or exciting causes have been put forward, some of which are of doubtful validity. I do not believe, for instance, that high acidity of the urine is a cause, and I am very doubtful about phimosis. Threadworms have been specially blamed by some, and their importance as a factor is worth discussing. On the other hand I am quite sure that adenoids and enlarged tonsils, especially if causing obstruction, may sometimes lead to enuresis—explain it as we may.

There is one interesting group of cases, however, which deserves special mention, a group small in proportion to the total number of enuretics, but perhaps larger than we think—namely, those in which the enuresis seems to depend upon a nocturnal polyuria, or, to put it in another way, upon a reversal of the normal relative amounts of day and night secretion. Such cases are not generally recognized, but they certainly exist. They may be detected either by actual measurement of the day and night urine or by finding that the specific gravity of the day secretion is unduly high, that of the night unwontedly low. To explain these cases is difficult. One is tempted to suppose that there must be a delay in excretion or some vasomotor factor at work, but these are matters we might well discuss.

There is likely to be some difference of opinion as to the part played by psychological factors in the production of enuresis. For my own part I have not found it commoner in difficult and “maladjusted” children than in others, and I confess I am not convinced of the reality of some of the alleged causes put forward by the extreme Freudians. It must always be remembered that those who work in child guidance clinics are seeing a selected material. They miss the sanitizing atmosphere of the general out-patient department.

Prognosis and Treatment

As to prognosis it will be generally admitted that enuresis usually disappears before puberty, although its continuance into adolescence is all too common, and it persists even into adult life oftener than is supposed. When all allowance is made for the fact that it is commonly recovered from, it is none the less a real nuisance, for it may interfere seriously with the patient's education and choice of a career, besides being a great social handicap. As a French writer has put it, the enuretic is often “socially dead.”

It is the question of treatment, however, which must chiefly interest us in such a discussion as this, and we must all, unfortunately, be convinced that there is no one plan which is sure of success; the very number of the remedies proposed is proof of this. It must also be noted that in a condition which may undergo sudden and

spontaneous improvement and the severity of which is affected even by such extraneous circumstances as the weather, it is more than usually difficult to assess the value of any particular measure, and often enough the remedy which is being used when spontaneous improvement happens to set in gains undeserved credit.

General Management

As far as the general management goes there is not much room for difference of opinion. All admit the importance of a firm mattress, adequate bed coverings, and abstinence from the ingestion of much fluid in the later hours of the day. “Accidents” may be rendered less disagreeable by the wearing of a thick pad of sphagnum moss, and I have sometimes, in the case of adolescents, recommended the use of a rubber urinal such as is worn by patients suffering from incontinence the result of spinal paralysis.

The “taking up” of the child when the mother goes to bed is really only a way (I would suggest) of dodging unpleasantness. It cannot be really curative, for the normal child does not need to be so “taken up.” None the less, it is a proper part of treatment.

Remote causes should be dealt with. By all means get rid of threadworms, although I cannot agree with some enthusiasts that they are the main cause of enuresis. I doubt if phimosis is worth dealing with, except on its own merits (or demerits), but I am convinced that I have seen cures result from the removal of tonsils and adenoids.

Use of Drugs

Among drugs belladonna has remained the most popular ever since it was first recommended by Bretonneau more than a hundred years ago, but its mode of action is ill understood. I usually give a dose about 5 o'clock in the afternoon and another at bed-time, gradually increasing the quantity up to a point just short of toxicity. It should be continued for some weeks and then gradually left off. Ergot also has a considerable reputation, although it is less used than formerly. It is difficult to see pharmacologically how it can do good, but I have had at least one case of the nocturnal polyuria type in which it seemed quite definitely to control the enuresis. Ephedrine has lately been recommended in a half-grain dose at bed-time, increased by another half-grain every week. It is said to act by increasing the tone of the sphincter whilst relaxing that of the bladder musculature. It will be interesting to learn the experience of anyone here who has tried it extensively. The endocrines, I think, will not help us much. A good deal has been claimed for thyroid in the case of the phlegmatic child with enuresis, but I consider the claims exaggerated. Pituitrin, from its antidiuretic action, ought theoretically to be useful, especially in the nocturnal polyuria cases, but it is an inconvenient substance to administer, and I have had no experience of it. I gather that those who have tried it have been disappointed with the results.

Psychotherapeutic Methods

The more heroic and semi-surgical procedures such as epidural injections, the passage of sounds, and so forth will, I imagine, be condemned by most of us, so we are left only with psychotherapeutic methods. As to the value of these there is considerable difference of opinion, although all are at one about the importance of creating the right psychological atmosphere for treatment by seeing that the disability is regarded in a common-sense and unemotional way and that the patient is not allowed to be either frightened or fussed. But can we do more than

this? Suggestion has been used in an endeavour to teach the child "to control the bladder during sleep." But can any child—or adult for that matter—be expected to exercise such control? Hypnotism I have never practised myself, and I have not been impressed by the results it has yielded in the hands of others. There is a form of suggestion for which success has been claimed in America and which consists in the weekly subcutaneous injection of 1 c.cm. of sterile salt solution. It is impressed upon the child at each injection that the treatment will certainly abolish the enuresis, but that if this should persist further injections will be required. For my own part I regard such treatment as a disguised form of punishment hardly to be distinguished from the use of the nurse's palm, and, besides, we should not lie to the young.

Of the more severe psychotherapeutic procedures such as Freudian analysis I cannot speak from any experience, but their use seems to me disproportionate to the object and rather like breaking a butterfly on the wheel. The value and limitations of this as of other methods of treatment in enuresis, however, it is one of the chief objects of this discussion to make clear.

CARE OF THE VOCAL CORDS IN SINGERS AND SPEAKERS*

BY

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In considering the care of the voice it will serve the purpose best if examples are drawn from experience with outstanding artists, just as, along other lines of achievement, one would take those who excelled in sport or politics. Therefore I shall point my moral by reference to some of the world's greatest singers as they have been heard from time to time at the Royal Opera House, Covent Garden, with which I have had a close connexion for over a generation. The same principles will apply to all who make exceptional use of the voice in their professions.

It is necessary first to ask, "What is singing?" and that opens up a previous question, "What is sound?" Sound is defined, from the physical point of view, as vibrations appreciable to the ear. Noise is the beating of the waves of air upon the ear-drum in irregular fashion, while in music the impingement is regular and periodic. In singing or speech the vibrations originate in an expiratory current from the lungs passing the edges of the vocal cords and setting them in motion, just as in the violin or other stringed instrument the pulling of the string creates the air waves and forms the note. The lowest audible vibration is 32 times a second; the highest, one of 76,000 times a second; but in music the vibrations employed range from 40 to 4,800, representing seven octaves.

In chest notes the entire length of the vocal cords vibrates; in head notes the length is shortened according to the note required. Falsetto notes are due to the false vocal cords situated immediately above the true ones acting as a damper on the outer part of the latter. The following table gives numerically the vibrations of the vocal cords for different voices:

	Vibrations per second	Average wave-length
Bass	87-256	12 ft.
Baritone	106-341	
Tenor	128-435	6 ft.
Contralto	160-512	3 ft.
Mezzo-soprano ..	192-640	
Soprano	Up to 768, occasionally higher..	1½ ft.

The beauty and the carrying power of the voice depend upon the breath control, which produces the requisite vibrations of the cords kept in a properly tense condition by the nerves of the larynx, together with a proper posing of the voice to obtain resonance from the sinuses of the head, these acting as resonating cavities or sounding-boards and also amplifiers. The best voices naturally are those which have the most and finest elastic tissues in the cords. If the edges of the cords are viewed with the laryngoscope during singing they appear as sharp as razor blades in the great sopranos. Bad tuition produces tiredness and redness of the cords, overstretching of the elastic fibres, and occasionally the appearance of nodules, while exceedingly bad tuition may even break the fibres and cause minute haemorrhages.

One inexperienced teacher sent me his first twelve pupils, three of whom had torn vocal cords as a result of his curious methods.

Modern Singing

Modern singing as taught to-day started only two and a half centuries ago. When one bears in mind the very small percentage of the population who can sing in any sense that can be called singing, the much smaller percentage who can sing really well, the relatively few who take up singing professionally, the fewer still who make a success of it even after years of serious training and great expense, one is led to the conclusion that singing is not a natural endowment, that the vocal cords were not constructed by Nature for singing purposes. Singing is an acquired accomplishment, into the service of which have been pressed certain organs not intended for it. The same conclusion is suggested by the multitude of troubles that afflict even the best singers.

If this be true, then there is no such thing as a natural singing voice. I have never heard of a leading opera singer who had not been taught how to sing. Singing is an acquired art, and that being so it follows that with more definite methods of teaching, greater experience, some anatomical knowledge, and care of the vocal cords, the best voices are yet to be heard.

Although many of the suggestions in this paper apply to the speaking voice as well as to the singing voice, the demands upon the singer are much more critical. An advocate in a court of law may use his voice for five or six hours a day and for several days running with no congestion of the vocal cords. He may permit himself occasional declamation, but apparently his voice is as tireless as, one may hope, is the attention of his auditors. Singers, on the other hand, after a long and heavy opera are often thoroughly exhausted and quite unfit for any renewal of the effort next day. It must be remembered, of course, that they have to act as well as sing, that frequently they are heavily clad, and very generally have more than the normal allowance of flesh. But one has only to consider the immense number of vibrations of their vocal cords, and the force with which their voice is projected, to understand that during their performance they are like engines running at excessive speed. These high notes with heavy volume mean an enormous strain, with subsequent exhaustion.

* Read in opening a discussion in the Section of Oto-rhino-laryngology at the Annual Meeting of the British Medical Association, Belfast, 1937.