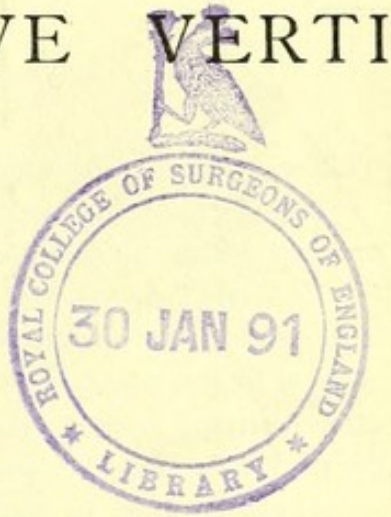
The diagnosis and treatment of auditory-nerve vertigo / by W.R. Gowers.

THE

DIAGNOSIS AND TREATMENT

OF

AUDITORY-NERVE VERTIGO.



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THE DIAGNOSIS AND TREATMENT OF AUDITORY-NERVE VERTIGO.*

THE form of vertigo which depends on a morbid state of the organ of hearing, and has been variously termed "auditory vertigo", "labyrinthine vertigo", or, from the name of the aural surgeon who first called attention to its more striking characters, "Menière's vertigo" or "Menière's disease", has passed, to some extent, from the province of special aural surgery into that of general medicine. The reason is not far to seek. The symptom vertigo has usually little or no apparent connection with its actual cause. Hence its origin is constantly unsuspected by the sufferer. Moreover, there exists frequently an obtrusive association between this giddiness and certain gastric symptoms, which has constantly been and is still frequently misconstrued, and the nature of the disease consequently misconceived by both the patient and his medical adviser. The object of this paper is to illustrate these associations, which so obscure the real relations of the symptom, and to consider the points which are of chief importance in its diagnosis and in its treatment.

It is not necessary here to do more than allude to the evidence on which the pathology of the disease is based. That evidence is of three kinds: first, the frequent association of paroxysmal vertigo with defect or disturbance of the function of the internal ear or auditory nerve; secondly, on some scanty pathological facts, which point to the existence in these cases of a morbid state of the semicircular canals; and, lastly, on the well known experimental evidence of the connection between the function of the semicircular canals and the maintenance of

* A portion of this paper was read before the meeting of the British Medical Association at Sheffield, August 1876.

the equilibrium of the body.* The theory of their function is, that they give information of the position of the head to a coordinating centre which presides over the equilibrium of the body, and which experimental physiology has located in the cerebellum. Into the question of the mechanism of the action and disturbance of the semicircular canals it is not necessary here to enter. Although the theory of varying pressure of the endolymph, originated by Goltz, and rendered more precise by later writers, appears highly probable, its application to the details of the normal action of the canals is still surrounded by uncertainties which render it difficult to frame a satisfactory detailed explanation of the phenomena of the disease.†

All that we can conclude is, that their morbid condition causes a morbid action of the centre of equilibration, which may so disturb the equilibrium of the body as to throw the sufferer to the ground, or may merely result in a sense of corresponding movement or of mere instability. It is important, for a clear comprehension of the symptoms of these cases, to remember that the sense of movement and an actual movement, subjective vertigo and actual rotation or falling, are aspects of the same process. It is the motor tendency to turn which is felt as subjective vertigo. This was pointed out long ago by Dr. Reynolds,‡ and its significance has been insisted upon from many points of view by Dr. Hughlings Jackson.§

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* An abstract of the facts, with references to the chief sources of information, has been given by Dr. Hughlings Jackson (*Medical Times and Gazette*, August 17th, 1872, and *London Medical Record*, 1874, pp. 238 and 254). The experimental evidence has been fully described and discussed by Dr. Ferrier (*Functions of the Brain*, p. 69, and *West Riding Asylum Reports*, vol. v).

† Assuming the theory of Mach, Breuer, and Crum-Brown to be correct, that the variation in the pressure of the endolymph in the ampullæ of the several canals, produced by the movements of the head, constitutes the means of their stimulation, it is reasonable to suppose that the equilibrium centre is influenced by *minus* as well as by *plus* variations in the pressure of the endolymph in the ampullæ. The excitation of the several ampullary nerves in various movements will therefore be a very complex matter, involving probably the mutual action of several canals, just as the guiding information as to the position of the eyeball, by which the equilibrium centre is also influenced, depends on the degree of contraction of several muscles, oblique and straight. It must be remembered, also, that the free communication between the canals will increase the complexity of their mutual relations.

‡ "Generally, in man, the tendency to movement is arrested by an effort of the will *per se*, or by grasping some object for support. The sensation of its production remains, and is projected onwards into the objects of the material world" (*On Vertigo*, 1854, p. 41).

§ "Giddiness is objectively a motor symptom, and the 'sensation' it is attended by is a state of consciousness accompanying the outgoing current" (*Clinical and Physiological Researches on the Nervous System*, Preface, p. xxv; see also *Medical Press and Circular*, December 2nd, 1874, p. 477.

Whether any impression from the semicircular canals enters into the total sensation is uncertain, but that the chief part of the feeling of vertigo, that of movement in the individual or in external objects, is the sensation of an "incipient motor process", is evident from the fact that the sensation in the slighter attacks is always in harmony with the movement in the severe attacks. If the patient feel as if he were moving, it is towards the side to which he does move in the severe paroxysms. If the sensation be merely one of movement in external objects, it is always from the side towards which the patient falls ; *i.e.*, it is the apparent movement of objects (say, to the left) which would result from an actual movement of the head or eyes to the right. In a case to be presently narrated, this was very marked. The practical significance of this is, that the character of the vertigo is an important aid in the diagnosis of its cause, and we are able to determine its character as accurately from such a subjective sensation as if we saw the patient reel. Hence the importance of ascertaining in every case of giddiness the precise character of the patient's sensation.

The derangement of hearing with which this form of vertigo is associated may be of two kinds. Sometimes there is evidence of undue excitation of the auditory nerve, noises in the ears, permanent or only at the moment of the paroxysm. More frequently, indeed almost universally, there is evidence of defective sensitiveness. This defect may be conspicuous or obscure ; may range from a considerable degree of deafness to a slight defect in audition, which it requires much care to ascertain. The knowledge that the defect may be limited to the perception of sound conducted through the bones of the skull is an important addition to our means of diagnosis. The fact was pointed out by the late Mr. Hinton* and by Mr. Dalby,† and cases in which it was noted have been published by Dr. Ferrier, Dr. Duffin, and others. This loss of what may conveniently be termed *perosseal audition* is regarded as evidence of an affection of the labyrinth or of the auditory nerve. It may be absolute ; a tuning-fork vibrating in contact with any part of the head or with the teeth may be unheard in the affected ear, while it is heard readily, if held opposite the meatus ; or the loss may be partial, and in that case it may be detected by the method, commonly employed by aural surgeons, of closing the ears while the tuning-fork is sounding in contact with the vertex or some other part of the skull. Closure of the meatus, if the latter be unobstructed, increases

* On Labyrinthine Vertigo (*Guy's Hospital Reports*, 1873).

† *Lectures on Diseases of the Ear*, 1873.

the intensity of the sound, if the perception of sounds conducted through the skull be unimpaired; renders the sound weaker or inaudible if there be impairment. But the method is one that requires much care and repeated examination to detect a slight defect in an unintelligent patient. It is important to examine these cases, not only with a tuning-fork, but with a watch. There may exist marked impairment of perosseal audition to the watch, while the tuning-fork is well heard.* I know a gentleman who has been subject for several years to slight attacks of vertigo. The motion is uniform, a tendency to fall to the left. His hearing is acute; it was thought to be perfect. A tuning-fork in contact with the head is heard perfectly well with ears open or closed. A watch placed opposite the ear is heard perfectly well; but the loudest ticking watch pressed against any part of the head is not heard in the least. The condition, however, in this case, is a variable one. At times, a watch in contact with the head is heard well; more frequently it is not heard at all. The liability to attacks of vertigo seems to correspond to the periods of imperfect audition. Whenever he has been tested after an attack, the power of hearing the watch has been always absent.

Even a slighter degree of impairment of the power of hearing a watch in contact with the skull may be of significance, as is shown by the following case lately under my care, in which the tuning-fork failed to reveal any abnormality in the function of hearing.

P. D., aged 56, admitted into University College Hospital on August 15th, 1876, had suffered during the last five years from startings on going to sleep, which lately occurred every night. Four months previously, he had a blow on the head and on the bridge of his nose from the fall of plaster. In June (two months before admission), he noticed a considerable degree of deafness of the left ear, which continued for a fortnight and then passed away. During the six days before admission, a confused noise in the left ear was noticed. Twice during the preceding month, he had an attack of giddiness of short duration, of which no

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* The method of testing perosseal audition with the watch which I have found most useful, is to hold the watch first close to, and then in firm contact with, the zygoma, the parietal eminence, and the mastoid process—the direct passage of the vibrations to the meatus being prevented by placing the hand as a screen between the watch and the ear in the two former positions, and in the latter by drawing forward the pinna. The effect of contact in the normal state is very marked. The watch not in contact is scarcely heard or inaudible, while in contact it is loud. This method of testing is somewhat coarse, but very convenient. The effect of closure of the meatus on the sound of a watch is slighter than on the sound of a tuning-fork; and although in health it is distinct, it is not sufficient to render this test a convenient one.

definite history could be obtained. The day before his admission, while walking, he suddenly became giddy, as if he were turning round, staggered towards the right side, and fell, as he says, in trying to recover himself. A slight sense of movement on his part and in surrounding objects continued until his admission. He then complained much of a "confusion of sounds", which seemed to be in his head, and of headache in the occipital region and behind the ears. His hearing at first seemed to be natural. A watch was heard a good and equal distance from each ear. A tuning-fork was heard at eight feet, and was well heard when sounding in contact with the head in various positions, and in each ear it was increased in loudness by closing the meatus. A watch was heard in contact with the head and on the right side; closing the meatus increased its loudness. On the left side, however, closing the ear rendered the sound less loud; the watch had a double beat, and closure of the ear rendered one set of beats entirely inaudible. This result was obtained in every examination both by myself and Mr. T. K. Rogers. (The patient was a very intelligent man, and his answers seemed trustworthy.) A few days after his admission, he had another severe attack of giddiness, with great "confusion of sounds in the left ear". His rest at night was much disturbed, and he turned about in his sleep until his head came to rest at the foot of the bed. Sometimes he lay curled round, with his head hanging over the edge of the bed. If he were awakened and put straight, on going to sleep again he soon returned to the former position. Five days later, he had another attack of vertigo, which continued in a slighter form for some hours, and some peculiar clonic spasm was noticed in the right arm and leg. He appeared able to control it when his attention was directed to it; but, when his attention was otherwise engaged, the spasmodic movement went on, the right hand being continually jerked up and down, so that the hand kept striking the epigastrium. At this time, he said he felt as if he were falling through the bed or swimming about the ward, so that an effort was necessary before he could realise that he was in bed. During the height of the attack, he complained of a continuous whirling or humming noise in both ears. A dose of chloral and bromide of potassium quieted him, and, on bromide of potassium and iron, he had no other severe attack while in the hospital.

In this case, the change in the hearing was so slight, that hesitation might well be felt in assigning any significance to it, were it not that the previous deafness on that side, and the noises in the ears, which accom-

panied the severer attacks of vertigo, give weight to the auditory defect, slight as it is. The occurrence of quasi-convulsive movements is a point of much interest, to which I will return. The remarkable postures assumed by the patient in his sleep are curious, and may perhaps be connected with the altered action of the organs or centres of equilibration. May the sudden startings on going to sleep be associated with the same condition? It is a well known fact that they are often related to a distinct dream of defective equilibrium.

But slight impairment of the power of hearing a watch or a tuning-fork, when vibrating in contact with the head, is not uncommon, even in persons who do not habitually suffer from vertigo. This is not surprising, since it is almost certain that the apparatus for the recognition of sound and of the position of the body are not the same, although they may be adjacent and even connected and supplied by portions of the same nerve. Even supposing, with Dr. Ferrier, that the semicircular canals are the channels by which the vibrations conducted through the bone reach the cochlea, we do not know that all disturbances of the semicircular canals cause vertigo. But I think some facts to be adduced render it probable that derangement of these canals may bring the centre of equilibration into an unstable condition, in which it is easily excited to sudden perverted action (paroxysmal vertigo) by some abnormal impression on the other nerves with which it is connected. It seems, therefore, that a morbid state of the semicircular canals may predispose to vertigo, as well as excite it. I shall return to this in speaking of the diagnosis of auditory and gastric vertigo, and shall mention some instances in which the attacks of vertigo appeared clearly predisposed to by aural, and excited by gastric, disturbance. A probable example of such a relation was afforded by a member of our profession, who, on two occasions near together, was seized with intense vertigo, brief but definite in character, the sensation being on each occasion that of a similar rotation. The attacks occurred after and were attributed to the inhalation of tobacco-smoke into the lungs. On subsequent examination of the sense of hearing, it was found that, while both tuning-fork and watch were heard when in contact with the head, closure of the left meatus rendered the sound considerably louder, while closure of the right meatus made little difference in the intensity of the sound. He had suffered from some ear-trouble in the right ear, after scarlet fever in early life; the ear was deaf for a time, but gradually, in the course of years, regained normal power. It is probable that, in this case, some permanent defect in the function of the semicircular

canals, which being slight, or being compensated or allowed for in the sensori-motor adjustments, did not cause vertigo, may yet have induced a state of defective stability in the centre for equilibrium, which the strong impression on the pulmonary pneumogastric nerve sufficed to overturn. The relation of the pneumogastric to the function of equilibration is well known. Dr. Hughlings Jackson has pointed out that the connection of its nucleus with that of the auditory nerve in the medulla, may explain the frequent occurrence of vomiting in the paroxysms of Menière's disease ; and has suggested that there is probably a still higher association between the two nerves.

The vomiting which accompanies the disturbance of equilibrium, and which is to be attributed to the association with the function of the pneumogastric, is the source, as already stated, of much of the misconception as to the nature of these cases. A few years ago, had the question been asked, What are the commonest causes of paroxysmal vertigo ? the invariable answer would have been " A disordered stomach or a diseased brain". It is probable that, even now, the exceptions to such an answer would be comparatively rare. The answer, at any rate, indicates the conditions from which the diagnosis of auditory-nerve vertigo has to be made ; for gastric and cerebral disturbances are probably, next to labyrinthine affections, the most common causes of giddiness, and the paroxysms of Menière's vertigo are constantly ascribed to one or the other of those conditions.

Diagnosis from Gastric Vertigo.—The gastric associations are especially liable to mislead. The occurrence of vomiting, in the absence of other obtrusive cause of the vertigo, is held as proof of a causal derangement of the stomach. Sometimes, an attack of vertigo may not cause vomiting ; it may merely disturb the gastric functions, just as the motion of a ship does with some persons in whom it does not cause seasickness. The dyspepsia which results is regarded as a sufficient cause for the giddiness. But, further, in persons the subjects of auditory vertigo, whose equilibrium nerves and centre are deranged, a primary gastric disturbance seems sometimes to excite a paroxysm of the special vertigo to which they are liable, and the gastric disturbance which thus brings on the attack is naturally regarded as its only antecedent.

An illustration of this is afforded by the case of a gentleman, who suffers from frequent attacks of intense dyspepsia and vertigo ; the former appearing to him to precede and cause the latter. The vertigo is sudden

and violent ; he has fallen with it, and would fall always if he were not careful. He cannot say to what side he falls ; but on one occasion must have fallen to the right, as he grazed the right side of his cheek. He is almost completely deaf on the right side ; a watch, in contact with the skull on that side, is quite inaudible. The hearing on the other side seems unimpaired. The deafness came on gradually about twelve years ago. He has been subject from boyhood to attacks of violent dyspepsia, with vomiting and prostration. In his youth they were as severe as they are now ; but he never suffered from vertigo until the onset of his deafness. Since that time, the dyspepsia and vertigo have gone on together. The paroxysms of vertigo in this case appear distinctly to be excited by the attacks of gastric disturbance. They are produced by errors in diet, and the long liability to such dyspepsia indicates that it is not to be regarded as secondary to the aural affection. But the sequence of the symptoms, the coincidence of the liability to vertigo and of the ear-disease, indicate clearly that the giddiness is ultimately due to the influence of the latter, although it is excited by the stomach-derangement.

A good illustration of the obscurity which gastric symptoms may confer on these cases was afforded by a woman, 50 years of age, who came under my care last spring at University College Hospital. She gave a long history of the symptoms of chronic ulcer of the stomach, for which she had been previously in the hospital. On examination, the stomach was found to be tender and evidently dilated. Vomiting was still frequent, occurring chiefly in the evening, when much of the food taken during the day was rejected. Giddiness was complained of as associated with the vomiting. When she was first seen, the giddiness was thought to be due solely to the gastric disturbance. Subsequent questions as to the character of the vertigo and the time of its occurrence elicited a very definite history of another kind. It appeared that the giddiness very frequently came on when there was no sickness ; that it occurred in paroxysms ; and that it was produced especially by sudden movements, as lying down, or sitting up, or turning round in any posture. In the attacks, the sensation was always of a definite character, being as if " something went over the top of the head from the right side to the left". If standing, she often fell, and, even if sitting, she would fall from the chair. She always fell to the right. Whether she fell or not, she always had, during these attacks, the sense of falling to the right and backwards, never forwards or to the left. Many attacks were witnessed. In some, she fell to the right ; in others, merely backwards, although she felt as if falling to the right. In

some, she almost lost consciousness ; could be roused with difficulty. She said that she had many times actually lost consciousness for a few minutes. During the attacks there was slight flushing of the face. The eyelids were closed ; on opening them, there was no dilatation of the pupils. The eyes were all the time in the median position, never turned either to the right or the left, even when the sense of falling to the right was most intense. The duration of the attacks varied from a quarter of a minute to several minutes. The vertigo commenced suddenly, but ceased gradually.

The definite character of the vertigo led to a careful examination of the state of hearing. It was found that a watch was heard less acutely with the right ear than with the left. (Right at one-third, left at two-thirds the normal distance.) She could hear all the notes of a piano ; but, after listening for a little time, the upper and middle notes suddenly ceased to be heard. After a little time, she could hear them again. The upper notes, she said, constantly sounded a "long way off and faint, like the strings of a guitar". She had noticed lately that her daughter's voice, in singing, sounded distant and "squeaky", quite unlike its ordinary character.

Audition through the bones of the skull was tested with the tuning-fork. Placed in contact with the top of the head, she said she could hear it in the left ear only. Placed on the left parietal eminence, she heard it invariably louder when the meatus was closed than when it was open. Placed on the right parietal eminence, she could hear it only faintly, and, when the meatus was closed, she could not hear it at all. Examination with a watch yielded the same result. The meatus was free from obstruction. She had been troubled with occasional singing and whistling noises in the right ear.

Sight was unimpaired, except by presbyopia. The ocular muscles were unaffected. Smell and taste were both diminished. Neither peppermint, assafœtida, nor camphor could be recognised. Neither citric acid, salt, nor sugar could be tasted on either side. Quinine was tasted a little. No pain was referred to the ear, but neuralgic pain and tenderness over the right side of the head were complained of, and, on examination, there was distinctly defective tactile sensibility in the parts supplied by the right fifth nerve. There was a good deal of general weakness and prostration, and she was liable to occasional attacks of great prostration, sense of dyspnœa, surface pallor, without marked failure of pulse. She was disturbed at night by starting in her sleep, accompanied with a sensation of falling : she would wake in a

perspiration. She constantly dreamed of falling, and dreamed that she saw other persons falling from heights.

Many drugs were tried to lessen the attacks of giddiness (bromide of potassium, belladonna, gelseminum, Indian hemp, etc.), but with no permanent benefit. Absolute rest in the hospital (when she was admitted under the care of Dr. Reynolds) was followed by marked improvement, and attacks of paroxysmal headache were effectually relieved by inhalations of nitrite of amyl, which had, however, no effect on her vertigo. At a later date, she thought that salicylate of soda did her more good than anything else.

The evidence of defective auditory function in this case is clear. The character of the vertigo, its paroxysmal and uniform character, render it probable in the highest degree that it was due to that morbid action of the right auditory nerve, of which there was independent evidence. The distinct affection of other cranial nerves suggests the probability that the impaired function was due to disease of the nerve-fibres rather than to primary disease of the other structures of the ear.

The more immediate interest of the case is, however, the combination which it presented of chronic gastric symptoms and auditory-nerve vertigo. The association was here conspicuously accidental, but the confusion in diagnosis which the association caused is typical. The same combination is constantly seen in cases in which the gastric symptoms are less pronounced. In this case, the distinction of the cause of the vertigo was easy, not only on account of its pronounced character, but because the gastric symptoms were those of organic disease, and organic disease of the stomach is less frequently accompanied by vertigo than the simpler disturbances (chronic gastric catarrh: Trousseau).

The sufferers from this affection, besides their acute attacks, are often liable to a slighter chronic sensation of disturbed equilibrium, the "interparoxysmal reeling" to which Dr. Hughlings Jackson has called attention. It may take the form merely of a vague sense of instability, which is expressed by the word "dizziness" and the like. This condition is often in constant relation to the gastric functions. The least stomach-disturbance at once excites the feeling, and most careful dietetic management is necessary, in order to keep the patient free from his annoying sensations. The following case is an illustration.

A patient aged 35 sought advice on account of chronic gastric disturbance associated with slight giddiness, which he regarded as secondary to the dyspepsia. His tongue was clean and appetite fair, but he complained of acidity, flatulence, and frequent sense of pro-

stration. There was marked epigastric aortic pulsation ; no cardiac murmur, but a weak impulse and soft radial pulse. The giddiness from which he very often suffered was vague in character, and was worse when his stomach was a little out of order. It was only on inquiry for ear-symptoms that he said his left ear was a little deaf, and that he had occasionally "singing" in it, especially when his dyspepsia was troublesome.

Some years before, he had suffered from attacks of sickness and giddiness, but could give no detailed account of them. He dated his present symptoms from a series of severe paroxysms of vertigo six months previously. The first of these occurred without warning or apparent exciting cause. He was walking with a friend, who was on his right hand. Suddenly, he felt something which seemed like a blow on the left side of the head behind the ear, and made him "whirl round" to the right and fall on his right side with such force as to knock his friend down also. He said that it seemed "as if the ground on his right suddenly rose up to him". He stuck his hands convulsively into the ground, but did not lose consciousness, calling out at once to his friend, "Let me alone ; I am giddy". In a few minutes, the giddiness gradually subsided, and he walked a mile or two home, but he had some difficulty in walking straight.

Two days afterwards, he had a second attack. He had been busy in law courts all day, and had omitted to take any food until long past his usual time. Then he had dinner, and afterwards walked along the street, when he suddenly found himself getting giddy. He had not time to call a cab, but managed to clutch hold of some railings. He seemed to hear a roaring sound in his left ear and fell towards the right. Although he held the railings with all his force, he could not prevent himself from falling against them and grazing his right cheek, and then sliding down to the ground. He believes there was no loss of consciousness ; for he remembers the chaffing remarks of bystanders on his presumed intoxication. The giddiness soon passed, but he felt for a time weak and prostrate.

The third attack was less severe. It occurred in bed soon after waking in the morning. He was lying on his back, when the bed on which he lay seemed suddenly to be rolling over from the right ; just as, in the first attack, the ground seemed to rise up from the right.

He had no subsequent attack until a day or two after my first interview with him, when he had a slight attack one evening while at supper. He did not fall, but all objects seemed to revolve round a

centre situated in front of him, those above the centre moving from right to left. Next day, he had an attack of diarrhœa.

When first seen, there was some wax in each meatus; but, after this had been completely removed by syringing, it was found that the hearing in the left ear was reduced to one-third. A tuning-fork in contact with the top of his head was heard, he thought, only in the right ear, but audition through the skull, tested by closing the meatus while a tuning-fork was sounding in contact with the parietal eminence, seemed defective in each ear. In each case, closing the meatus rendered the sound less distinct, and the diminution was greater on the right side than on the left. The watch in contact with the skull, however, was heard on the right side, and not at all on the left.

The case is thus a fairly typical one of auditory vertigo. The noise in the left ear at the moment of the onset of the vertigo points to that ear as the chief seat of the mischief, and with this the defective perosseal audition of the watch corresponds, although the defect in the perosseal audition of the tuning-fork was greater in the right ear. The movement in the attacks was, therefore, as usual, from the side on which the ear was affected. The association of the giddiness and the gastric disturbance was marked both in some of the severer attacks and in the more persistent slight giddiness.

The most important point, then, in the diagnosis of auditory from gastric vertigo is the recognition of an impairment of the function of the auditory nerve shown, first, in deafness, and, secondly, in tinnitus, and the most significant change is the loss of the power of hearing a watch in contact with the skull. The point of next importance is the character of the vertigo. The sensation which results from a primary gastric disturbance is usually vague, a confused sense of defective equilibrium; that which results from a labyrinthine affection is definite, a sense of movement in a certain direction, subjective or referred to other objects. This statement is not in complete accordance with the descriptions of gastric vertigo which have been given by Trousseau and other writers, who have described vertigo of very definite character as the consequence of gastric disturbance only. But the fact that the patient may be unconscious of a most significant auditory defect, lessens the value of former observations as evidence of the definite character of stomachal vertigo. My own conviction is that, in the vast majority of the cases in which a vertigo of definite and uniform character is apparently excited by gastric disturbance, an auditory defect will be discovered on careful examination. In a small proportion of cases, no auditory

defect may be found. In some of these cases, there may be disturbance of some other sensory nerve also related to the function of equilibration. But, on the other hand, the sensation which attends a labyrinthine disturbance may be vague in character. Hence definiteness in the character of the sensation is of greater value as suggesting a primary affection of the auditory nerve or the centre of equilibration, than is the absence of definiteness as excluding such a source of the giddiness. Lastly, the sequence of the gastric symptoms and vertiginous sensations is of some significance, although, as we have seen, this may easily be misunderstood. Vomiting, dyspepsia, or diarrhœa, after an attack of vertigo, is no evidence that dyspepsia is the cause of the trouble. Gastric derangement before the vertigo may be a primary cause of the vertigo, or may merely excite an attack in the presence of a derangement of the equilibrium centre.

Diagnosis from Cerebral Disease.—Vertigo may be a symptom of cerebral disease, and the attacks which result from a labyrinthine affection may be of such a character as to simulate very closely those of cerebral origin. This resemblance depends chiefly on the occasional occurrence of loss of consciousness in the attacks of auditory vertigo, and on their suddenness. Sudden loss of consciousness may be a symptom of two forms of cerebral disease, apoplexy and epilepsy, and from each of these auditory-nerve vertigo has to be distinguished.

From Apoplexy.—The resemblance to apoplexy struck Menière very forcibly, and the affection was accordingly termed by him "apoplectiform". Instances are occasionally met with which merit such a designation. A medical friend is now suffering from indubitable auditory-nerve vertigo, whose first attack was of an apoplectiform character. Now, the attacks are always referred by him to gastric disturbance. Although the sensations are described as intense giddiness and inability to stand, there is no definite sense of rotation or tendency to fall in a definite direction. The first sensation is a sense of suffocation and of oppressive heat; he then bursts into a perspiration and feels intensely giddy, so that he is obliged to lie down. As long as he is lying down, the sensation of giddiness ceases; but, if he attempt to rise, it comes on again. For many years, since an explosion near him, he has been partially deaf in the right ear. A watch is heard six inches from the left, but is not heard at all with the right ear. A tuning-fork vibrating in contact with the skull is well heard in the left ear, and increased by closure of the meatus. He thinks he can hear it in the right ear, but it is not

increased by closing the meatus. He has continuous tinnitus in the right ear. When at his best, the noise is like a "dull buzzing"; but, if his stomach be deranged, or if overworked, the sound rises to a persistent hissing, "like an engine". It is greater for some hours before an attack of giddiness, but is not louder at the moment of an attack. His first attack was one of sudden and profound loss of consciousness, without much giddiness. He was walking in the City, when he suddenly lost consciousness and fell. He probably had no convulsion, but was taken to a hospital, where he was thought to be in a state of post-epileptic coma. Some hours passed before he recovered consciousness. The second attack, however, was attended with vomiting and no loss of consciousness.

But the cases are rare in which the loss of consciousness is so considerable and so lasting as to render the diagnosis a matter of real difficulty. A speedy return of consciousness, coupled with the persistence of vertigo and the absence of any symptoms of local weakness, generally renders the nature of a case sufficiently obvious. The history of preceding attacks will also indicate the nature of the affection. In a first attack, as in one depending on an acute inflammation of the semicircular canals, a diagnosis might be for a time impossible.

From Epilepsy.—The attacks of auditory nerve vertigo resemble those of epilepsy in several particulars. This resemblance is of much significance. A sensation of vertigo often attends the slighter attacks of epilepsy. In these, however, consciousness is usually, but not always, lost, while consciousness is usually preserved during the paroxysms of auditory nerve vertigo. Severe attacks of the latter may be accompanied by sudden, transient loss of consciousness. The sufferer may even fall, and be unaware that he has fallen. A patient whom I once saw immediately after an attack had fallen a hundred yards from the place to which he was going, and had then walked to the house, but could not say how he had got there, and did not remember the fall, of which his clothes showed proof. He retched, vomited, and giddiness persisted for an hour. In this case, there had been many attacks of auditory vertigo, and there was no suspicion of epilepsy.

The common features of the two conditions are instructive. No doubt the significance of the feeling of vertigo is in each state the same. In each, it depends on an "incipient motor process" (Hughlings Jackson). In each case also, there may be a developed motor process. The violence of the movement, in severe attacks of auditory nerve

vertigo, is remarkable. It is no mere compensatory action to maintain a disturbed equilibrium; the patient is dashed to the ground with force. In the case detailed at p. 13, the patient fell on one occasion with great violence; while, on another, his grasp at some railings was insufficient to prevent him from being borne down to the ground with force. In a case mentioned by Dr. Ferrier, a patient was turned round three times and then dashed to the ground. Such movement must result from the "discharge" of a motor centre, quite analogous to the discharge which occurs in an epileptic fit. If we locate the centre for equilibration in the cerebellum, we may perhaps regard Menière's disease as a cerebellar epilepsy, reflex in character, determined by an irritation of the semicircular canals,* alone or in conjunction with impressions from some other nerves with which the centre is in connection, as those of the pneumogastric nerve. On this view, it is not difficult to understand the loss of consciousness which may accompany the severer seizures, since the connections of the cerebrum and cerebellum are intimate; fibres from almost all parts of the hemispheres being gathered into the superior cerebellar peduncles.

It has been remarked that ear-diseases may excite actual convulsions, apart from any direct affection of the brain. Such cases have been described by Mr. Hinton, Dr. Brown-Séquard, and others. Many attacks of auditory vertigo present other symptoms resembling epileptic seizures, which might render it doubtful in which category they should be placed. A premonitory sensation, apparently unconnected with the ear, may be present. In the case of Menière's disease related by Dr. Duffin, some attacks were preceded by such a sensation, which passed from the hypogastrium to the occiput. A case, presenting very interesting symptoms of this character, has been lately under the care of Dr. Ringer in University College Hospital. The patient, a man about forty years of age, was bitten by a dog, about three months before admission, in the back of the right leg, below the calf. The wound was cauterised and healed, but a few weeks afterwards became painful; and one day a sudden pain seemed to start from it, pass up the leg and

* M. Pierret, in a recent communication on the origin of the auditory nerve (as Dr. Hughlings Jackson has lately mentioned), appears to doubt whether its fibres can be traced with any certainty so far as the cerebellum. The direct evidence contained in Dr. Lockhart Clarke's paper in the *Philosophical Transactions* for 1868 is, however, very convincing, especially his comparative investigations on animals. Indirect evidence is afforded by the fact which he points out, and which I have repeatedly verified, that a large number of the fibres of both divisions of the auditory nerve (the anterior especially) pass into the substance of the restiform body and mingle with its fibres, and the restiform body passes entirely to the cerebellum.

side of the trunk to the right side of the head behind the ear, and then his head seemed to go round and round "like the wheel of a steam-engine", in what direction he could not say. He had many slighter attacks, and, after the giddiness had subsided, a pain seemed to pass up the leg and down the arm to the palm, backwards and forwards. He was conscious of no auditory defect; but it was found on examination that, while the hearing on the left side was in every way normal, that on the right side was distinctly defective. A watch was not heard so readily opposite the ear as on the left side, and whereas its sound on the left side was much increased in intensity by contact with the skull, it was not heard at all when in contact with the skull (zygoma or mastoid process) on the right side. There was also some persistent defective equilibrium: in walking, he experienced a constant tendency to go to the left; but he explained this by describing it as the corrective of a tendency to go to the right. The probable explanation of this case I think to be that the equilibrial centre, being disturbed by the morbid state of the auditory apparatus and nerve, was further perverted by the irritation from the bite, which developed sudden overaction in the centre, an "irradiating" action of the sensory centre being set up at the same time. It is evident that, as sensations from all parts of the body are or may be concerned in the maintenance of equilibrium, all sensory regions must be related to the equilibrial centre.

If the paroxysmal auditory nerve vertigo be thus due to an epileptoid process, it is to be expected that the condition of instability of nerve-cells, such as we recognise as an important element in the pathology of epilepsy, may influence in some cases the occurrence of this affection. The only way in which such a condition of nerve instability could be recognised as a factor in Menière's disease would be by the coexistence of epilepsy and auditory nerve vertigo. Of course, much care and even hesitation is needed in diagnosing auditory nerve vertigo in the presence of epilepsy; but in two cases, at present under my care, there is, I think, clear evidence of the coexistence of the two maladies.

One of them, a married woman aged 65, began to suffer from epileptic fits at the climacteric period, at about 47; the fits continued for six or seven years, and then ceased. All the fits were the same in character; they were preceded for a day or two by slight fainting attacks, and a slight feeling of faintness was the immediate warning of some of the fits. During the attack, consciousness was lost, and there was slight jerking. She slept afterwards, and on waking had occipital

headache. For twelve years, she has had no fits. During the last two years she has suffered from vertigo, paroxysmal; the attacks sometimes come on when sitting still, but are more often induced by a sudden movement, especially by looking up. The sensation during an attack is that of falling backwards and towards the right. It always comes on sufficiently deliberately to enable her to take hold of some object and save herself from falling. She never loses consciousness. She frequently vomits with the attacks, and refers them to "biliousness". She was conscious of no defect in hearing; a watch is heard on each side at nine inches from the head. A watch, pressed against the left parietal eminence, is heard slightly, but on closing the ear she ceases to hear it. A watch in contact with the right parietal eminence is not heard at all, with the ear open or closed. (The meatus is free from obstruction.) On each side, a watch in contact with the malar bone, and shielded by the hand from the ear, is unheard. A tuning-fork on each side, in contact with the parietal eminence, is heard, but less loudly when the meatus is closed than when it is open. The effect of movement on the giddiness was tested: a sudden jerk of the head backwards brought on an attack; a sudden rotation of the head to the right also brought on an attack, while a sudden rotation to the left had scarcely any effect. During the six weeks before she came under treatment, she had two more fits, of the same character as the earlier ones. Since the recurrence of the fits, the giddiness has been more troublesome.

In the other case, a girl has suffered from several epileptiform convulsions, and has almost constant vertigo, varied by severe paroxysms on movement. The giddiness is worst after rising in the morning. The sensation is of falling backwards and to the left. She has constant noises in the ears, and is generally, though not always, unable to hear a watch in contact with the head. Occasionally, a watch is heard faintly when in contact with the mastoid process. This patient suffers at night from twitching of the right limbs. A similar symptom existed in the case of the man whose strange postures during sleep have been described, and indicates a tendency on the part of the motor centres to spontaneous discharge. She is also troubled with startings in sleep, as were several other patients whose cases have been detailed. It may be suggested that, in this case, the epileptiform convulsions are really excited by the aural affection. But such an explanation will not apply to the other case mentioned; and I believe that convulsions have not been described as the consequence of anything but a severe ear-disease.

It will be seen from these remarks that the diagnosis from epilepsy must turn, as in the case of gastric disturbance, to some extent on the detection of defective audition, and especially on defect in the power of hearing vibrations conducted through the skull. The definite character of the vertigo is in these cases no criterion. A more important symptom is its persistence between the paroxysms and its long duration in the paroxysms themselves. Its relation to movement is also important. If it be related to change of posture, and can be produced by certain sudden movements of the head, it is probably due to auditory nerve disturbance. In the latter, the attacks are succeeded by vomiting, much more frequently than are the attacks of *petit mal*. Lastly, there is rarely the objective evidence of momentary loss of consciousness, which is so frequent in minor epilepsy; in auditory nerve vertigo, consciousness is only lost or obscured in severe attacks, in which the giddiness persists for a considerable time and vomiting is frequent.

Production of Auditory Nerve Vertigo. — Before speaking of the treatment of this affection, it is worth remark that auditory nerve vertigo can be produced artificially. Quinine produces a sense of confusion with tinnitus; but very definite symptoms (of vertigo and defective hearing, especially perosseal) may be caused by salicylate of soda. This was shown very strikingly in the case of a patient lately under treatment for acute rheumatism in University College Hospital (under the care of Sir William Jenner). The patient was a woman aged 40, whose hearing was supposed to be unimpaired. She was not subject to giddiness. It was her first attack of acute rheumatism, and there was no cardiac affection. On January 26th, salicylate of soda was commenced in doses of twenty-five grains every three hours. On the 28th, she complained of noises in ears, deafness, and giddiness, which the next day had increased so much that the salicylate was omitted. The following day the giddiness was much less, and on the 31st had almost gone. On February 6th, the same dose was resumed; on the 7th, the same symptoms were complained of. The noises in the ears were constant; a watch was heard only at two inches distant from each ear, and was not heard at all on either side when in firm contact with either the zygoma or mastoid process. A tuning-fork on the vertex was heard fairly well, but the sound was not increased by closing the ears. The giddiness was slight and indeterminate as long as she lay still, but was very con-

siderable and definite when she raised her head or sat up. Objects before her all seemed moving to the right. On the 8th, these symptoms continued, and the salicylate was discontinued. On the 10th, the giddiness was gone, and she could hear the watch at a distance of six inches from either ear, and could hear it, although faintly, in contact with the zygoma or mastoid process, but not when in contact with the parietal eminence. On the 23rd, the salicylate was resumed, and, eighteen hours after its resumption, deafness and giddiness had returned, which again ceased a day or two after the discontinuance of the drug. When the patient was convalescent, a careful examination of the state of hearing revealed very little abnormality, the only difference being that the watch in contact with the skull was not quite so distinct on the right side as on the left. In another case, I have seen similar symptoms of deafness and definite vertigo produced by salicylic acid.

Treatment.—The direct treatment of labyrinthine affections is a subject for the special aural surgeon. I would only here indicate that, when there is evidence of an irritative process, blistering behind the ear sometimes affords very marked relief to the vertigo. Occasionally, there is evidence of a constitutional condition on which the aural disturbance is dependent. In some cases the patient is gouty, and there is reason to believe that a gouty change in the membranous labyrinth is the cause of the morbid action. This was the case in one of Mr. Hinton's patients, and also in one case which has come under my own observation. Marked relief is afforded under these circumstances by colchicum and potash. In rare cases, the vertigo depends on a syphilitic inflammation of the labyrinth. Such a case has been lately described by Moos of Heidelberg.* One of the most severe forms of paroxysmal vertigo I have seen was in a child, with almost complete deafness and every sign of inherited syphilis. In all syphilitic cases, the specific treatment is, of course, required.

It has been just remarked that certain drugs have a marked influence on the organ or nerve of hearing. The effect of quinine induced Charcot to employ it, in full doses, in a case of auditory nerve vertigo, with some beneficial result. I have tried it, but have not found any marked effect was produced on the vertigo. The influ-

* Virchow *Archiv*, vol. lxix, part ii, p. 313. The patient suffered from attacks of giddiness and noises in the ears; and, later, rapidly increasing deafness. *Post mortem*, there was found a small-celled infiltration of the membranous labyrinth, and especially of the ampullæ.

ence of salicylate of soda upon the equilibrium, which I have described, suggested its use in this disease. Equilibrium is maintained by the balance of opposing impressions ; its overthrow is the result of the loss of that balance. In our ignorance of the way in which salicylic acid produces the disturbance, it is conceivable that it may, in some cases, have such an influence as to counteract the morbid action, and lessen the disturbance of equilibrium. This it has seemed to do in one or two cases in which I have tried it. It does not remove the giddiness, but in some cases lessens its intensity. It has been given in doses of from five to ten grains three times a day. The patient with gastric ulcer, whose case has been narrated above, thought that she was better while taking the salicylate than when taking any other medicine. Its effect, unfortunately, seems after a time to become less.

One of the objects of this paper is to show that, in auditory nerve vertigo, other morbid conditions may concur with the aural condition in causing the vertigo. The knowledge of this will, in many cases, enable much relief to be given. The gastric disturbances are to a considerable extent under control, and, by their removal, the attacks of vertigo which they excite, although ultimately dependent on ear-disease, may be much lessened in frequency and intensity. The most unremitting care in diet and regimen are, however, necessary. An actual attack, which has been produced by gastric irritation, may often be arrested by a good dose of an antacid.

Lastly, any undue sensitiveness of the grey matter of the equilibrial centre must be lessened. For this purpose, no remedies are so useful as the bromides of potassium and ammonium, and several observers have noted their utility in Menière's disease. It is probable, indeed, that bromide does more good in this condition than any other single medicinal agent. This fact affords another point of resemblance between epilepsy and paroxysmal vertigo. The effect of the bromide is in some instances increased by the addition to it of some other sedative, as belladonna. Other sedatives alone—opium, Indian hemp, gelseminium, hyoscyamus—have seemed to me without effect.

Auditory nerve vertigo is unquestionably, in many cases, a very obstinate affection ; but, when the several factors in the individual cases are sought out, and as far as possible corrected, a considerable amount of relief may be afforded. In several cases that I have seen, immunity for long periods has been obtained. The patient, whose severe attacks were described at page 13, has had no severe attack since the com-

mencement of the treatment, now a year ago. Occasionally, he notices slight unsteady feelings, "as if the ground were being tilted up a little". When this is the case, he takes a few doses of bromide of ammonium, carbonate of bismuth, and belladonna, and the symptom always vanishes. Bromide alone gives less relief than this combination. In another case, in which there were other indications of an irritable nerve-centre, bromide and bark produced an almost complete cessation of the attacks; and the improvement was subsequently maintained on a course of quinine only, although quinine had at first failed altogether to relieve.

It is on a recognition of the associations of auditory nerve vertigo, and their place in the pathology of the affection, that its treatment can be most effectually based.