HERPES ZOSTER OTICUS.

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OF late, much has been written on the subject of herpes zoster and herpes, and Levaditi especially, by his exhaustive study of the subject, has shown conclusively that herpes and herpes zoster, though analogous, are two separate clinical entities. They differ in two main points—(1) Localisation of the virus and its manifestation: (2) In experimental inoculation of the vesicle contents.

(1) *Localisation.*—Zoster selects primarily the "spinal" ganglion or, to a much less extent, the primary, sensory neurone, and manifests itself as an anatomically circumscribed skin eruption on the segment of skin which is normally supplied by the affected nerve; it is unilateral as a rule. On the other hand herpes affects primarily the skin generally, its favourite sites being around the mouth, lips, nostrils, and on the genital mucosa, with mayhap an involvement of the corresponding primary, sensory neurone. It is thus seen that zoster is mainly neurotropic in selection, whereas herpes is dermotropic. Levaditi thinks that neurotropic and dermotropic affinities are independent and, up to a point, antagonistic.

(2) *Experimental inoculation* was carried out by Levaditi on the rabbit's cornea, this animal being most suitable as apparently scarification of its cornea does not react to the ordinary organisms of sepsis. Inoculation of the contents of the vesicles from herpes gave a definite keratitis, which was not followed by an immunity, the same animal, when cured, being infected again and again with each subsequent inoculation. Similar inoculation with the vesicle contents from zoster cases gave uniformly no reaction (Levaditi). This is attributed to the rather attractive theory put forward that, as zoster is neurotropic, the virus is thus fixed and consequently cannot be found in its vesicles. On the other hand, the virus has never been definitely isolated from the attacked ganglion.

Recently Ullmann has inoculated a rabbit's cornea with the bleb contents (sterile from a bacteriological standpoint) from a case of myringitis bullosa, which is, according to some

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authorities (Gatscher), a neurogenic process through which vesicle formation takes place. He was able to produce a keratitis which was transmissible, but which conferred a lasting immunity after the primary inoculation. Doerr finds that in the positive cases of inoculation of the human subject with zoster, a very localised eruption appears at the site of inoculation; this is followed a few days later by a generalised condition akin to chicken-pox, the incubation period being nine to fourteen days, while in herpes the incubation period was never more than from one to four days. There is a very close relationship between herpes zoster and chicken-pox. Briefly, such are the present-day views. However, there is no doubt about the separate entity of herpes and herpes zoster.

Zona has long been known to be an acute infectious disease occurring in the nervous system with a localisation in the "spinal" type of ganglion, and is now generally recognised to be due to a specific filterable virus. It is epidemic and seasonal. It is highly probable that this virus is disseminated by the saliva. Levaditi considers it incontestable that the specific germ of herpes zoster lives a saphrophytic existence in contact with the mucous membrane of the nasopharynx and tonsillar crypts. Ruttin has also remarked on some similarity between epidemic poliomyelitis and herpes zoster oticus, and we know that the virus causing the former disease has been found in the secretions of the nasopharynx. John Fraser (Professor of Clinical Surgery at Edinburgh University) thinks that in acute anterior poliomyelitis the lesion is situated temporarily in the posterior horn (hyperæsthesia of skin segment) before taking up its final position in the anterior horn. At some period favourable to the germ, it penetrates the endothelium of the capillaries and thus gains entrance into the blood stream, producing a transient septicæmia which is marked by the initial symptoms of fever, general pains, etc. Thence it seeks out the nervous tissue for which it has a special predilection, the nerve axis, and having settled down on a locus there, it spreads by way of the perineural lymphatics towards the centre and, in a lesser fashion, towards the periphery. This seems the most likely route of infection.

Another mode of infection is said to be an ascending spread from a lesion at the peripheral nerve endings and so along the nerve sheaths towards the centre, in much the same manner as tetanus.

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Herpes Zoster Oticus

The attacked ganglion shows hæmorrhages, perivascular infiltrations of monocytic cells and some degeneration of the *nerve cells. In the healing condition proliferation of the* capsule, resorption of the extravasated blood and, to a certain extent, some regeneration of the nerve cells are seen.

The following case illustrates clearly the neurotropic affinity of Zona, and is also of interest because of the multiplicity of its lesions.

I. B., female, aged 23 years, was admitted on 12.2.26 to the Ear and Throat Department of the Royal Infirmary with a history of painful blisters along the left border of the tongue, occurring fourteen days before admission, with slight loss of taste. A few days after the appearance of the blisters the patient had a slight rise of temperature and indefinite pains, resembling a "feverish chill." Four days later she had slight pain and deafness in the left ear, but no giddiness, and, after a further period of three days, a left-sided facial paralysis developed. The temperature became normal two days before admission. She was not in contact with chicken-pox, nor did she know of the occurrence of any other cases of herpes zoster. She never had chicken-pox in childhood, but her aunt and grandmother suffered from "shingles."

Examination on Admission. — A well-marked left-sided facial paralysis was noted. The tongue was furred but was protruded straight; the vesicles on the tongue had disappeared and there was no loss of taste on the anterior part of the tongue on either side. There was no paralysis of the left side of the soft palate. The vocal cords also moved normally. No glandular enlargement was noted.

Left Ear.—There were no vesicles on the auricle and the left drumhead was normal. With the noise-box in the right ear, the patient was absolutely deaf. The tuning-fork on the vertex was lateralised to the good ear. On testing the vestibular apparatus, it was found that cold syringing of the left ear for three minutes produced no reaction: rotation to the right produced only slight nystagmus to the left for eight seconds.

Right Ear.—The right drumhead was normal and the hearing on this side was also normal. Cold syringing of the right ear, however, produced no reaction in three minutes, while rotation to the left only produced slight nystagmus for seven seconds.

The patient was examined by Professor Edwin Bramwell and by Dr A. H. H. Sinclair, who found no further nerve paralysis and no ocular abnormality. (No spontaneous nystagmus.) The Wassermann blood test was negative. On lumbar puncture the cerebrospinal fluid was found to be clear but under tension. Examination of the fluid showed a total of 9 cells per c.mm.; colloidal gold reaction, 000 000 0000: Wassermann reaction negative. Chemical examination of the cerebrospinal fluid—chlorides, 690 mgm. per cent.; sugar, 80 mgm. per cent.

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Progress—7.4.27.—The facial paralysis has completely passed off. There are no signs of any scarring along the left border of the tongue.

Left Ear.—Rinné's test negative: no air conduction: Weber's test—tuning-fork on the vertex lateralised to the right ear: bone conduction greatly shortened. With the noise-box in the right ear, the patient is still absolutely deaf in the left ear. Cold syringing of the left ear for two and a half minutes produced a very feeble nystagmus. Rotation to right produced after-nystagmus to left—for horizontal canal, 13 seconds: for frontal canals, 13 seconds: for sagittal canals, 19 seconds. Galvanic test (unipolar method), left side, well-marked nystagmus with 5 milliamperes.

Right Ear.—Cochlear tests normal. Cold syringing of right ear for two and a half minutes produced well-marked nystagmus. Rotation to left produced after-nystagmus to right—for horizontal canals, 20 seconds: for frontal canals, 20 seconds: for sagittal canals, 18 seconds. Galvanic test, well-marked nystagmus with 5 milliamperes.

Anatomy.—The present case is characterised by an involvement of neighbouring ganglia (Scarpa, Spiral, and Geniculate) and of the facial nerve on one side, and, on the opposite side, by the involvement of an isolated ganglion (Scarpa). It is not difficult to explain this multiple involvement if the comparative anatomical relationship between these structures is kept in mind (Fig. 1). At one time the present-day seventh and eighth nerves were commonly regarded as one nerve—the seventh nerve—although it was differentiated into two portions according to the consistence—Portio Mollis (acoustic, which is devoid of neurolemma) and Portio Dura (facial).

The acoustic nerve passes with the facial and intermedius nerve into the internal acoustic meatus and divides there into its separate components, the cochlear and vestibular nerves. The vestibular nerve ends by dividing, in the internal acoustic meatus, into (1) the pars superior and (2) pars inferior which supply (*a*) the utricle, superior and lateral canals, and (*b*) the saccule and posterior canal, respectively. Along the course of this nerve are scattered the ganglion cells (Scarpa) and these are arranged in two groups, superior and inferior, which correspond to the terminal branches. These ganglia are therefore intra-meningeal. The cochlear nerve runs into the modiolus and its ganglion cells (Spiral) are located in the spiral canal of the modiolus (extra-meningeal). Between the nerve fibres in the cochlea there are large lymph spaces which play an important part in the extension of inflammatory processes.

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The cells of the above ganglia are bipolar and oval or spindle-shaped, the cells of the vestibular ganglia being larger in size than those of the cochlea. They are of the "spinal type" of ganglia, originating from the same neural or ganglionic ridge of ectoderm, as the spinal ganglia. In the early embryonic

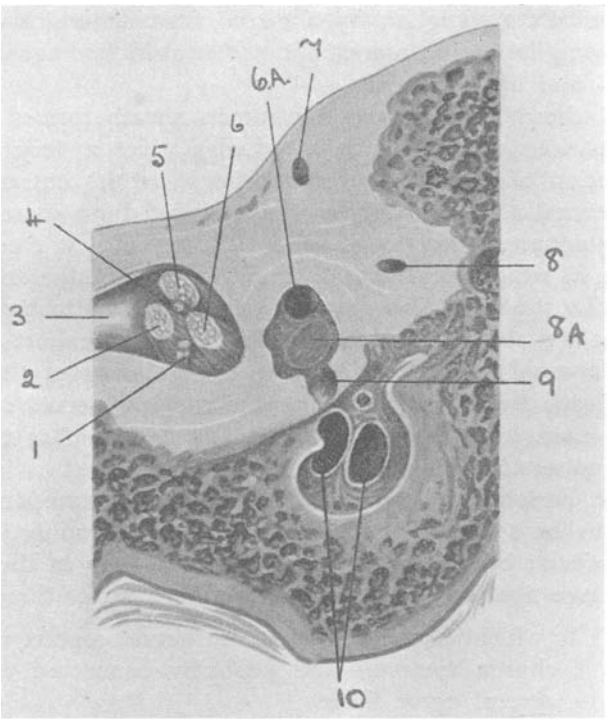


FIG. 1.—Frontal Section through the Pyramid. (*After* Alexander.) To illustrate the nerve relations in the Internal Acoustic Meatus.

1. Nerve to ampulla of posterior semicircular canal.
2. Cochlear nerve.
3. Internal acoustic meatus.
4. Nervus intermedius.
5. Facial nerve.
6. Vestibular nerve.
6A. Lateral ampulla.
7. Superior semicircular canal.
8. Lateral semicircular canal.
8A. Stapes foot-plate-medial aspect.
9. Round window.
10. Hypotympanum.
Dense bone surrounding the membranous labyrinth.
Bone with marrow spaces and air cells.

state all these ganglia are bipolar, but as development proceeds they become unipolar with the above exception. Sharpey-Schafer has found that in certain fish the spinal ganglia are permanently bipolar.

The intermedius nerve passes with the facial, to which at first it is loosely attached, then more intimately. It forms at

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the geniculum of the facial nerve, the geniculate ganglion, and is continued as the chorda tympani nerve.

The cells of the geniculate ganglion are unipolar and pear-shaped; they are larger in size than those of the vestibular ganglia. This ganglion conforms to the "spinal type" of ganglion. The superior vestibular ganglion is connected to the geniculate ganglion by a nerve filament which contains some ganglion cells, representing a transition stage between the bi- and uni-polar cells.

All these nerves have a common sheath formed by the continuations of the meninges. Lange gives a very accurate description of them. The eighth nerve, at its entrance into the internal acoustic meatus, is surrounded by a more or less loosely adherent process of the arachnoid until it reaches the fundus, at which point the arachnoid becomes adherent to the wall. To the facial this arachnoid covering is attached chiefly in front and above and it follows the nerve for a short distance into its canal, where it merges with the lining of the latter. The sheath leaves the vestibular and cochlear nerves, however, sooner than it does the facial and attaches itself to the dura mater so as to enclose the entire areæ cribrosæ.

The peripheral distribution of the chorda tympani nerve will now be considered. It has a very close connection with the auricular branch of the vagus nerve. Gray in the course of his investigation on this point has differentiated three types:

(1) In which Arnold's nerve is in actual contact with the chorda tympani and probably connected to it by several nerve fibres.

(2) Where a branch is given off by the facial nerve to Arnold's nerve from the same point as that at which the chorda tympani nerve leaves it.

(3) Where Arnold's nerve appears to arise directly from the chorda tympani nerve.

From this statement the "geniculate zone" (Fig. 2) in the external ear can be arrived at, namely, the posterior half of the drumhead, the posterior wall of the external meatus, and the concave surface of the auricle, or in other words, the distribution of Arnold's nerve.

The chorda tympani ends by uniting with the lingual nerve to supply the anterior two-thirds of the tongue with general taste and common sensation.

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It is not common to find such an insignificant peripheral manifestation and it shows up clearly the neurotropic affinity of the Zona virus. Levaditi thinks that an intense neurotropic manifestation can counteract the dermotropic one, and that the pain appears to be in proportion to the skin lesion. (See Notes of Case.) This rather widespread involvement of the disease is probably due to the strength of the infection.

Dennis finds that usually the ganglion of one nerve bears

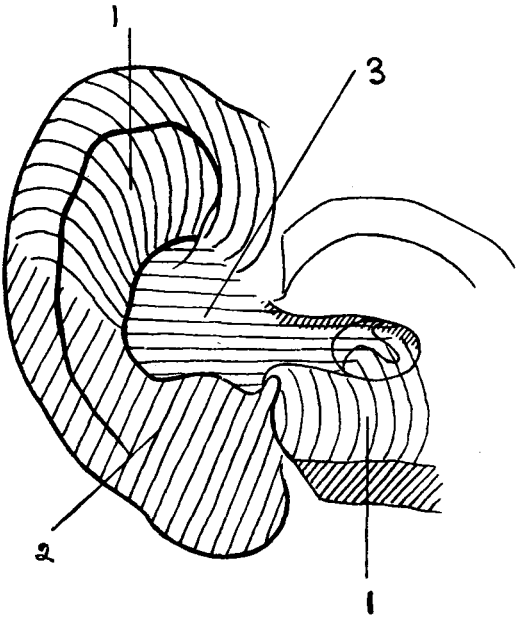


FIG. 2.—Diagram showing the sensory nerve supply of the auricle, external auditory meatus and drumhead. (The anterior wall of the external meatus has been thrown down.)

1. Auriculo-temporal nerve. 2. Great auricular nerve.
3. Geniculate zone—Arnold's nerve.

the brunt of the attack and that those, above and below, are affected to a lesser degree.

Ramsay Hunt's words, modified to meet the interpretation of the present case, would read thus—"The occurrence of facial palsy with auditory symptoms, while the geniculate zone is comparatively free, is explained on the basis of multiple involvement of the ganglia in Zona, the chief focus being situated in the acoustic ganglia; at the same time an inflammatory reaction is present in the geniculate, which is

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sufficient to produce only a very slight eruption but which suffices to implicate the adjacent motor fibres of the facial nerve."

Or the facial nerve may have been in this case temporarily damaged by the œdema originating from the attacked ganglia, the rigid bony walls of the internal auditory meatus allowing no relief from the increased pressure (*cf.* Herxheimer's Reaction).

One would have expected the symptoms of Ménière's disease (giddiness, vomiting, nystagmus, tinnitus) to be present but, excepting the deafness, these were absent. J. S. Fraser suggests that Ménière's symptoms were absent because *both* vestibular nerves or ganglia were affected (*cf.* syringing both ears with cold water produces no giddiness, vomiting, or nystagmus).

The findings in the cerebrospinal fluid are suggestive of some meningeal involvement; some investigators claim to have isolated the Zoster virus from the fluid. Greenfield and Carmichael state that a slight mononuclear pleocytosis (5 to 10 cells) may occur in herpes zoster but that a severe pleocytosis (50 to 200 cells) is rare, and that there is no relationship between the severity of the disease and the degree of change in the cerebrospinal fluid.

The condition in the case recorded is clearing up; the facial paralysis has disappeared and the right vestibular nerve is now almost normal, while the left vestibular nerve is improving. The left cochlear nerve, however, is unchanged. The ultimate prognosis is good.

Conclusion.—The subject-matter goes to prove that the vestibular ganglion was primarily involved on each side. The ganglion is intrameningeal and thus is responsible for the changes in the cerebrospinal fluid. On the left side the infection has spread up the large lymph spaces in the substance of the cochlear nerve to the spiral ganglion, and also along the nerve filament, connecting the vestibular ganglion to the geniculate. The further course of the infection is problematical. It may be due to a spread downwards along the chorda tympani nerve with a participation in the infection by the lingual nerve, or it is conceivable that the tongue lesion might have been due to a primary infection of the Gasserian ganglion. On the right side the infection has remained localised in the vestibular ganglion.

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