

paroxysmal, and there are no intervals of entire cessation of the morbid action; there is not the great reflex excitability of tetanus and the occurrence of cramps on slight irritation peculiar to that disease, and in spinal meningitis the tonic rigidity is succeeded by paralysis. Hydrophobia is very similar to tetanus, but it develops more slowly; there is a special antipathy to water and inability to take it when other articles may be swallowed, and a peculiar hawking noise is made, to dislodge a little viscid secretion from the throat, peculiar to this disease. Trismus may be limited to the muscles of mastication, and may be produced by colds and exposure, but it is confined to these muscles and does not become generalized. Those cases occurring in the course of cerebral disease are also diagnosticated by the symptoms of such diseases, which have no relation to tetanus.

Treatment.—Whenever an obvious cause exists it must be removed. If a wound, splinters of bone and foreign bodies should be searched for; if a cicatrix, it should be dissected out; if an injured nerve, it should be divided. The remedies which have been most successful are those which diminish the reflex function of the spinal cord. Bromide of potassium seems to have been the most successful agent thus far employed. It must be given in very large doses—from one to two drachms every four hours, until the spasms are decidedly diminished, when the quantity may be somewhat reduced. Given early, and the effect maintained until the spasms cease, it must be regarded as the best remedy in view of the large proportion of cures. Next to the bromide is curara, which acts on the end-organs of the nerves and on the reflex faculty. This must be given hypodermatically, and the effect produced must be the guide. As curara is a very uncertain substance in its composition, the dose necessary can only be determined by trial, but, inasmuch as one eighth of a grain has been administered at a dose, it will be prudent to commence with one fortieth of a grain, and increase it until some effect on the spasms has been caused. Nicotine has similar properties and powers, and has been used hypodermatically in tetanus and in strychnine-poisoning with success. The author has seen a very severe case of traumatic tetanus treated successfully with the wine of tobacco. Physostigma and eserine have been now employed in a large number of cases and with excellent results. Eserine can be given subcutaneously, beginning at one sixtieth of a grain and increasing it until some effect is produced on the spasms. Cannabis Indica has also arrested some cases of tetanus, and is a very promising remedy. Recently urethane has been proved to have the most complete antagonism to strychnine, and is strongly recommended as a remedy for tetanus. The spinal ice-bag and the continuous current have proved palliative. Warm baths and the vapor-bath have given comfort, and have exerted a temporary influence over the spasms. An estimate of the value of a remedy is much affected by the period at which it is administered, for the longer the case has

lasted the more hopeful. The nutrition of cases of tetanus is highly important, and from the beginning they should be carefully fed. Noises and excitement, every form of peripheric irritation, and emotion of all kinds, should be excluded. As there is strong temptation to use ether and chloroform freely because of the relief they afford, the author desires to caution his readers, because of the injury so often done by them.

DISEASES OF THE PERIPHERAL NERVES.

NEURITIS.

Definition.—The word *neuritis* signifies inflammation of a nerve, but there are several distinctive maladies which may be grouped under this designation. There is a simple neuritis, in which one or more nerves may be affected by some local cause, usually trauma, and this may be either an *acute* or *chronic* inflammation. *Toxic neuritis* is that form of the disease induced by some poison introduced from without, as lead, copper, arsenic, etc. *Diathetic neuritis* arises from some systemic condition, such as rheumatism, gout, syphilis, etc., or it is due to the blood changes in typhoid, diphtheria, scarlet fever, and similar diseases. Again, neuritis, in consequence of conditions not well understood, manifests a tendency to spread from its point of origin and involve many other nerve trunks, whence we have *ascending neuritis*, *multiple neuritis*, and *progressive multiple neuritis*.

Causes.—The influences affecting the inflamed nerves are necessarily various. Simple neuritis is produced by wounds, injuries, and by the transference of the morbid action from a neighboring inflamed tissue. Thus, intercostal neuritis is caused by an adjacent pleuritis, or tuberculosis of the lung; sciatica, by a pelvic abscess or inflamed hæmorrhoids; and caries of bone may involve a nerve or plexus of nerves in the vicinity. As neuritis may occur in various nerve trunks simultaneously, and without apparent cause, there is, probably, a peculiar type of nervous system in which such an action is prone to take place. It is probable, also, that the occurrence of neuritis, in cases of fever and septic diseases, is due to the constitutional type of the affected individual, for such an accident is quite unusual. The special causes which originate and maintain progressive multiple neuritis are quite unknown.

Pathological Anatomy.—The first step in the process is hyperæmia: exudation takes place into the nerve, which becomes softened and ultimately breaks down into a diffuent mass. Migration of white corpuscles takes place into the neurilemma, an exudation partly serous, partly fibrinous, and minute extravasations occur between the fasciculi,

and then suppuration and softening result. Recovery may ensue before disintegration of the nerve elements is produced. The fibrinous exudation undergoes the usual changes—the watery part is absorbed, the solid matters and the corpuscular elements become fatty and are then taken up, and health is restored. In the chronic form of neuritis the change is less toward pus-formation and softening, and more to hyperplasia of the connective tissue. The nerve forms intimate adhesions to the neighboring connective tissue, the medulla undergoes fatty degeneration, and the nerve-fibers and axis-cylinder atrophy. These changes may occur in particular parts of the nerve, giving it a knobbed appearance, whence the term *neuritis nodosa*. It is important to note that when inflammation occurs in a nerve it may extend from the point first diseased upward (*neuritis ascendens*), or downward (*neuritis descendens*). By the extension of an ascending neuritis the spinal cord may be ultimately affected.

Symptoms.—If an important nerve or plexus is inflamed, there may be some fever preceded by chilliness, or a decided chill, headache, and general muscular soreness; but the most pronounced symptom is pain in the nerve, not only at the point inflamed, but spreading thence over the peripheral distribution. The pain is of a very distressing kind; it is a burning, tingling, tearing, and intense pain, and is increased by motion or pressure. There is a high degree of sensitiveness in the region of the inflammation; numbness and formication are mixed with the pain, and ultimately the parts supplied by the nerve become anæsthetic, which means destruction of the nerve, or pressure sufficient to prevent the transmission of impulses. If the nerve inflamed be motor in function as well as sensory, there will occur spasmodic contractions and cramps in the muscles to which the nerve is distributed; then will follow paresis, and ultimately paralysis, if the nerve is compressed or destroyed. Besides the general fever accompanying the neuritis, there is a local elevation of temperature in all the region of distribution of the nerve. In the chronic form there do not occur the constitutional symptoms which are present in the acute form, but pain and other symptoms of sensory irritation, and cramps and other symptoms of motor irritation, do appear. Besides the effects of neuritis within the distribution of the affected nerve, various reflex and radiation phenomena are manifest. Pain is felt in all the branches of the same plexus, and cramp in the muscles innervated from the same source. Wasting and degeneration of the muscles and anæsthesia of the parts innervated by the affected nerve are results of the neuritis. Various trophic disturbances are also caused. Various forms of cutaneous eruptions appear—herpes, eczema, and “glossy skin”; the nails become clubbed, the hair falls out, and the joints swell and change in structure. The affected nerve in the stage of irritation responds more readily to electric currents; if the nerve is simply compressed the muscles may respond normally, yet if destroyed there will be no reac-

tion to faradic stimulation, but to the galvanic: in other words, after the increased excitability to electric stimulation, the characteristic reactions of degeneration will come on.

Progressive Multiple Neuritis.—Simple acute or chronic neuritis manifests a tendency to extend from the point of original mischief upward. In progressive multiple neuritis, this tendency to extension upward is the most distinctive characteristic of the malady. It is also widely diffused, numerous important nerve-trunks becoming simultaneously affected. It is either occurring more frequently than formerly, or it is a comparatively new disease. It may be that more exact knowledge renders its differentiation more certain. Since Dumenil published his observations, the first that had been made, various cases have been reported. After Dumenil, examples of the disease, with comments, were published by Eichhorst,* Jaffroy,† and others. Last year Dr. Webber, of Boston, published an important memoir, based on cases he had observed. Some cases have been encountered by the author, and he has now a very complete example in his charge. It is probable that this disease, sometimes, has been mistaken for progressive muscular atrophy.

Progressive multiple neuritis is an acute affection, marked at the onset by chilliness, fever, and tingling pains, with coldness of the hands and feet. As in all acute inflammatory affections of the nervous system, there are two distinct groups of symptoms: those of the first stage, significant of irritation; those of the second stage, indicating depression. The irritation symptoms are due to the congestion of the nerve sheaths and trunks, and the beginning exudation; the anatomical elements as yet remaining intact, respond to the irritation caused by new materials in the tissues. As compound nerves are those affected, obviously the symptoms must include both sensibility and motility, pain and spasm being the result. Tingling, burning, and lightning-like strokes in the paths of distribution of the nerve-trunks of the extremities are experienced. The ulnar nerve and its terminals appear to be specially affected. The nerves, the seat of pain, are found to be very tender on pressure, and the intramuscular filaments being also affected, any muscular movement causes suffering, which may be so severe that the patient maintains as complete repose as possible. During this period of heightened sensibility there occur, also, motor phenomena of a corresponding character. With the onset of the irritation of the motor nerve-fibers, the muscles innervated by them become spastic, tense, and disposed to contract, or may be seized with spasms. The reflexes are heightened, and the responses to stimulation assume the character of tonic cramp. The electrical reactions correspond; there is an increased readiness of response on the part of

* Virchow's "Archiv," vol. lxix. "Neuritis Acuta Progressiva."

† "Arch. de Physiol. Norm. et Path.," 1879, p. 172. "Névrite parenchymateuse, spontanée, généralisée ou partielle."

the sensory nerves with pain, and of the motor nerves with tetanized contraction. But the morbid action continuing, in a short time the increased sensibility is succeeded by anæsthesia and analgesia. The tactile sense is blunted so that the points of the æsthesiometer are only recognized when widely separated. The senses of pressure, of temperature, and of locality become equally blunted. The muscles grow weak, paretic, and are presently paralyzed, and with the paralysis rapid wasting ensues. The atrophic degeneration begins in the small muscles of the hand, and thence extends to the forearm, and in these parts it continues more pronounced than elsewhere, but all the paralyzed muscles undergo more or less change, and exhibit finally the characteristic reactions of degeneration. The cutaneous and tendon reflexes are also abolished. The skin, nails, and hair undergo atrophic changes.

The acute symptoms last from a few days to a few weeks, and during this period the sensory and motor disturbances become well defined. The disease then assumes a chronic character, and continues on from two months to two years. In the favorable cases, the disease does not diffuse so widely, the paralysis is less complete, and the trophic changes are not so pronounced. In the most favorable cases, there may be permanent wasting and deformity of the muscles innervated by the ulnar nerve, the little and ring finger remaining contracted, shriveled, and almost useless, and the hypothenar eminence shrunken. In the unfavorable cases, the chief nerve-trunks of the extremities are invaded, the nerve-roots and the spinal cord become diseased, and the four members are disabled. An extension of the neuritis may take place to the medulla with the production of the characteristic results in the respiratory and circulatory systems, or the patient may be cut off by an intercurrent malady, as pleuritis, pneumonia, or phthisis.

The prognosis as regards danger to life is favorable, as but few cases die. Protracted suffering, paralyses, and deformity may be looked for in the more chronic cases, and recovery, when it ensues, is apt to be clouded by the disabilities.

Course, Duration, and Termination.—The acute form is necessarily of short duration. Recovery ensues, permanent disability results, or it becomes chronic. Restoration is possible only before disintegration of the nerve. The chronic form has no fixed duration. Recovery is more likely to ensue when there has occurred a simple injury or exterior pressure, which may be removed, than when an idiopathic or rheumatic inflammation has taken place. The latter are apt to become very protracted, to have periods of remission and exacerbation, thus continuing for years. The prognosis will be largely determined by the character of the symptoms—pain and muscular cramps, indicating the stage of irritation—anæsthesia and paralysis, the stage of injury to the nerve-trunk. Very important in this connection is the electrical diagnosis; for, if the irritability of the muscles to the faradic current is preserved, the nerves are still intact, and *vice versa*. As neuritis

manifests a strong tendency to ascend, in the course of the malady secondary degeneration of the spinal cord may ultimately take place.*

Diagnosis.—The differentiation of neuritis from myalgia is effected by reference to the points of tenderness—to the symptoms of irritation, succeeded by those of depression of a nerve; from neuralgia, by the fever in the acute form, by the changes in the trophic condition of the skin, and by the state of the muscles and the reactions of the faradic current.

Treatment.—The various causes of the disease must be removed. Here surgical treatment of wounds and injuries may be invaluable. In acute cases of plethoric and vigorous subjects, leeches should be applied along the course of the nerve. A full dose of morphine and quinine should at once be given (gr. ss.—gr. xv for an adult), and the tincture of aconite-root (two drops every two hours); or morphine may be given subcutaneously if the pain is severe. In the chronic cases, the most effective remedies are galvanism and the hypodermatic injection of morphine. The positive pole is placed on the tender spot or spots, and the negative at the peripheral expansion, daily application of a few minutes' duration being made. A succession of flying-blisters, or the electric brush, or the oleate of morphine, may be used locally, the iodide of potassium, colchicum, etc., internally in the more obstinate cases.

ATROPHY OF THE NERVES.

Pathogeny.—Atrophy of the nerves arises from various causes: from central diseases, of which examples are afforded by posterior spinal sclerosis, progressive bulbar paralysis, infantile paralysis, etc.; from peripheric lesions, as injuries by wounds, or compression of tumors, etc.

Symptoms.—The disturbances by atrophy are part of the morbid complexus of various affections, and consist in depression of function, wasting of the muscles, paralysis, and, as regards the sensory nerves, anæsthesia.

NEURALGIA—NEURALGIA OF THE FIFTH NERVE.

Definition.—Neuralgia of the fifth nerve has received various designations—*prosopalgia*, *tic-douloureux*, *Fothergill's disease*, etc.

Causes.—The causes of *tic-douloureux* may be comprehended in three groups—constitutional, immediate, and remote. Heredity is an important factor, since this disease is one of numerous maladies possible to the neurotic temperament or disposition. It is not unfrequently associated with epilepsy, as Trousseau was the first to point out. It

* Vulpian, "Archives de Physiologie," vol. ii, 1869, p. 221, "Expériences relatives à la pathogénie des atrophies secondaires de la moelle épinière."

may occur at any age, but is more frequent from the middle period, on, and in women at the climacteric period. Anstie* insists on the importance of the degenerative changes of age as causes of the origin and of the intractable character of some cases. The female sex seem more susceptible than males. Certain dyscrasias, as lead, syphilis, malaria, etc., are undoubtedly causative. Anæmia, amenorrhœa, a depressed state of the bodily functions, the exhaustion induced by excesses in venery, gout, and rheumatism, are predisposing causes. Psychological impressions, especially if depressing, are held by Anstie to be causative. Changes in the structure of the nerve, tumors, exostoses, and aneurisms, caries of the bones, periostitis, gummata, etc., are among the immediate causes. Decayed teeth, indigestion, worms, constipation, menstrual derangements, etc., are among the remote causes.

Pathological Anatomy.—The changes of neuritis have been sometimes observed in the trunk of the nerve and in the ganglion of Gasser. More frequently no changes have been noted. The nerve is more often affected by exterior pressure. In one of the most severe cases ever witnessed by the author, the nerve was impinged on by an aneurism of the basilar artery, and was very much thickened and softened. Probably the most frequent pathological condition is the pressure of an exostosis, or other form of tumor, on the trunk of the nerve within the cranium.

Symptoms.—The usual history is that of gradually increasing pain in the face or teeth. At first the attacks are regarded as merely tooth-ache, and tooth after tooth is extracted in the vain hope of finding the painful one. It may be months before the pain assumes the characteristic expression. Then distinct paroxysms occur, than which nothing can be more horrible. A sudden pain pierces the face, the muscles of that side are convulsed, the eye is injected, and the tears flow—the patient starts up with a terrible groan, rubs the cheek vigorously, wrings his hands, cries out in the extremity of his agony, rushes about his apartment, and it may be suddenly the pain ceases and the paroxysm is over, or it gradually subsides. At first these attacks may be weeks, even months apart, but after a time they get more numerous. In the interval between the seizures there may be entire freedom from pain, but in many cases there is nearly constant soreness, or aching, in the jaws or eyes. When the pain is wholly paroxysmal, the attacks are more frequent, and, in the interval between them, the patient experiences a tense feeling in the affected region as if the slightest movement on his part would excite a paroxysm. When this sensation comes on, he durst not move, he can not be spoken to, every muscle is in a state of tension and immovable, he hardly breathes, he looks straight before him in an attitude of suspense and apprehension. In

* "Neuralgia and its Counterfeits," London, 1871, p. 31.

spite of the dreadful energy of the self-control, his effort often fails, the pain comes on with a lightning-stroke, his teeth set hard, the face pales, the pupil dilates; then he abandons himself to his suffering, he starts up with a groan, and repeats the rubbing, the wringing of hands, the cries, etc. Ultimately so sensitive become the peripheral nerves, that the slightest touch, a breath of air, excites the paroxysm, and the attempt to take food produces the most frightful torments, the face is thrown into spasms, tears run down the cheeks, and the patient utters horrible groans. So dreadful is the aspect of this suffering, that these unfortunates must needs eat alone. When there is constant suffering, there are certain places in which the pain is felt—at the points of emergence from the bony foramina of the different divisions, and where certain filaments become superficial. The frontal and supra-orbital, the infra-orbital, and the mental, are examples of the first class, and tenderness and pain are developed by pressure on the nerves at these foramina. These are nearly if not quite constant; but those are less so, felt at the points where the nerves become superficial. The pains radiate from the painful points in both directions, but chiefly toward the periphery, and from the center, on other nerve-trunks—on the pneumogastric, on the occipital, etc. The sensibility of the part, innervated by the affected nerve, is altered; there may be merely perverted sensations, tingling, formication, etc., or anæsthesia when the case is old, hyperæsthesia when the attacks are recent. Photophobia, amblyopia, blepharospasm, and spasms of the facial muscles occur during the paroxysms. Various vaso-motor disturbances ensue, such as herpetic eruptions (zoster), eczema, falling out of the hair, a glossy state of the skin, ophthalmia, in old cases, and in the recent attacks, injected conjunctiva, lachrymation, swollen face, thickened skin, injected nasal mucous membrane, etc. When paroxysms are brought on by eating, and when sleep is prevented, the general health declines, but otherwise there may be no constitutional symptoms. Tic-douloureux may occur in one or all divisions of the fifth; more frequently it is either confined or is most violent in one of these divisions. When the ophthalmic division is affected, pain extends into the forehead and temples, the eyelid, and the eye itself. The principal painful spot is at the supra-orbital foramen; there is considerable hyperæmia of the conjunctiva, photophobia, and spasm of the orbiculus palpebrarum. When the second division is attacked, the pain is felt in the superior maxilla, in the teeth, and the upper lip. The principal tender point is at the infra-orbital foramen. When the third or inferior maxillary division is attacked, the pain is felt in the lower jaw, and in the teeth, and the most certain painful point is the mental foramen.

Course, Duration, and Termination.—Tic-douloureux may be several years in its development, attacks of pain becoming gradually more severe, better defined, and paroxysmal. It is therefore a chronic