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CLINICAL ASPECTS, THERAPY, AND PROPHYLAXIS OF ENCEPHALITIS

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Inflammation of the brain is called encephalitis. It may be primary or secondary. In primary encephalitis, the inflammatory changes in the brain are of primary origin. To this group of encephalitic diseases belong epidemic encephalitis (Economo's disease [Encephalitis lethargica]), tick-borne (spring-summer) encephalitis, Japanese encephalitis, American [St Louis] encephalitis, and others. Secondary encephalites originate as complications after a basic infection in various common diseases; in this category of diseases belong influenza, malaria, measles, and others.

In this report, we shall deal only with some basic forms of primary encephalitis which are encountered most frequently.

I. EPIDEMIC ENCEPHALITIS

The first cases of epidemic encephalitis were described in 1915. Since that time, several epidemic outbreaks and sporadic cases of this type of encephalitis in various countries have been described in literature.

The causative agent of epidemic encephalitis has not yet been discovered. It apparently belongs to the group of filtrable viruses. It is assumed that the virus of epidemic encephalitis is found in the nasopharynx. Under certain conditions, the virulence (infectiousness) of the virus increases; it assumes neurotropic properties and penetrates into the central nervous system. During the cold season, the infectiousness of the virus increases and the resistance of the organism is lowered, causing a predisposition to this disease during the fall and winter.

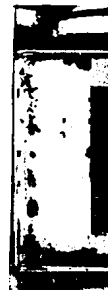
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In anatomic investigations of the brains of fatalities due to epidemic encephalitis, hyperemia and edema of the soft brain membranes, as well as of the brain matter, and small point hemorrhages were found. The pathological process is localized mainly in gray matter of the brain, and the inflammation manifestations are most sharply expressed in the basal ganglia in the midbrain, the pons, and in the upper section of the medulla oblongata.

In the USSR, the first cases of this disease were observed in 1918. Epidemic encephalitis affects people of any age, but the 20-30 year group is most susceptible.

The manner of infection with epidemic encephalitis has not been definitely established, but there are indications of the possibility that the infection is transmitted directly or through intermediate carriers. Cases of intrafamily or intrahospital infection are very rare. The length of the incubation period is not known.

Epidemic encephalitis is characterized by its highly variegated clinical picture and great diversity of symptoms. Clinically, two stages of development of epidemic encephalitis can be distinguished: the acute stage and the chronic stage. The disease usually starts slowly. In these cases, the patients suffer for several days from malaise, rheumatic pains in the whole body, headache, dizziness, noises in the ears, lack of appetite, and lowered working capacity. During this period, catarrhal manifestations in the upper respiratory tract are observed occasionally, frequently suggesting grippe. The temperature is slightly raised but generally remains subfebrile. In some cases, the onset of the disease is acute, with the temperature rising to 39°C from a state of perfect health. There is no characteristic temperature curve for epidemic encephalitis. The basic complex of symptoms in the acute period of the disease amounts to disturbed sleep and disturbance of the oculomotor functions.

The disturbance of sleep shows itself by extreme sleepiness for several weeks or longer. In this period, the patient feels a great need for sleep. Sometimes this excessive amount of sleep alternates with persistent insomnia. Occasionally, a reversed rhythm of sleep is observed, with the patients sleeping the whole day through and being unable to fall asleep at night. One characteristic feature is that the patients can sleep in any position and under any condition. The effect on the oculomotor mechanism is most frequently expressed by disturbance of the function of the muscles raising the upper eyelid. Drooping of one or both eyelids is one of the most frequent symptoms of the acute period of the disease. The malfunction of one of the external eye muscles leads to double vision. Double vision, as well as disturbed sleep, are characteristic indications of the acute period of epidemic encephalitis. In some cases, coordination of the eyes is interfered with; disturbances of convergence and paralyzes of fixation occur.

Vestibular disorder (vertigo) is among the frequent symptoms of the acute period. In some cases, involuntary spasms and compulsive movements are noted even in the initial period of the disease. Cases of encephalitis with extremely severe and persistent pains in various parts of the body, neck, trunk, and extremities have also been described. In children, in addition to disturbed sleep and oculomotor functions, various hyperkinetic and spastic states are observed. In such cases, there is also disturbance of the rhythm of breathing, myoclonia of the respiratory muscles, and breathing tic expressed in compulsive coughing, sneezing and yawning. In early childhood cases, a meningeal complex of symptoms often occurs. The spinal fluid, both in children and in adults, is clear, flows out under somewhat increased pressure, and in some cases contains an increased quantity of cellular elements. In the blood, moderate leucocytosis and a decreased number of neutrophils are observed.

The duration of the acute period varies within wide limits. Some symptoms continue for a few days, others last several months and longer.

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The course of the disease is frequently characterized by periods of improvement and aggravation. Lethal outcomes occur during the first days or weeks of the disease, but in a number of cases death may take place at a much later stage of the disease. Full recovery without aftereffects is rare (up to 10 percent of all cases). Some of the cases turn into chronic forms.

In addition to sharply expressed clinical symptoms, abortive or ambulatory cases are frequently observed. In these cases, one or several weakly expressed symptoms are noted, connected mainly with disturbances of the oculomotor and vestibular apparatus.

The course of the disease in these abortive forms is more favorable, but occasionally it later turns into the chronic form. According to the findings of most investigators, there is no direct relation between the gravity of manifestations in the acute stage and further development of the disease. Very grave cases, with strong manifestations of the failure of a number of functions during the acute period, may end in recovery, and, conversely, light and previously almost unnoticed cases may develop into parkinsonism after a certain period of time (from 6 months to several years). The basic features of parkinsonism are: disturbed sleep expressed in the form of sleepiness, insomnia, or inversion (sleepiness during the day, insomnia during the night), sparse and slowed motions, rigidity of the musculature, absence of expressive coordinated movements, tremor, oculomotor malfunction, increased salivation, and repression of mental processes. The above picture of such patients is typical.

In patients suffering from parkinsonism, the head is usually bent low and the face is sallow, anemic, and mask-like, with an unflickering, frozen gaze. The eyes are involuntarily directed upward and become fixed in this position for a while. The patient frequently stares fixedly straight ahead; there is copious flow of saliva from the mouth. The trunk is inclined slightly forward, the arms and hands are bent at the elbow and at the radial wrist joints, the wrists and fingers tremble, and the fingers perform peculiar motions suggesting pill rolling. Muscle tone is increased; voluntary movements are slowed down, rigid, and monotonous; initial movements are not carried out to completion. Thus, for instance, the patient takes hold of a spoon in order to carry it to his mouth, but fails to complete the motion. A new effort is required to finish the initial motion, and frequently his hand starts to tremble just as he has lifted the spoon to his mouth, so that the food is spilled. Changing from one position to another is accomplished with difficulty.

The patient will lie for hours without moving and without changing position. Special and often repeated commands are necessary to make the patient get up, walk, and take nourishment. The patients walk with small steps, without swinging their arms. Their speech is expressionless, monotonous, and indistinct; they have difficulty pronouncing words. Emotional experiences are not reflected in facial expressions. The psychic productivity is lowered; thought processes are dull and slowed down; the mood is changeable, and a dull and depressed state predominates. The character and personality of the patient frequently change. The patient becomes irritable and hard to get along with, and flies into a rage for no good reason. Obstinacy, tenacity, and pestering people with one and the same question or idea are most characteristic indications of parkinsonism.

The change of the psyche is noted particularly in children who have gone through epidemic encephalitis. In such cases, extraordinary mobility and restlessness are noted. The child becomes completely incapable of taking part in organized activities. His attention is attracted by all surrounding objects, but is not held by any of them; the child runs aimlessly around the room, is capable of striking and spitting at people, pinches and bites, and is rude and impertinent to adults.

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The child frequently wakes up at night, and suffers from insomnia and fits of unmotivated excitement. Sharp increase in sexual desire is also a frequent symptom; school children and teen-agers masturbate openly, not bothered by anyone's presence. For such patients, disturbance of the emotional-volitional sphere with relative retention of intellect and memory is characteristic. The psychic change takes place in various degrees and intensities, beginning with slight changes of behavior and ending, in rare cases, with a complete change of the child's personality as a whole. Such children are frequently patients in psychiatric institutions.

The course of encephalitic parkinsonism is chronically progressive. The prognosis, as regards recovery, is poor. There are no specific means of curing epidemic encephalitis.

In the acute stages, as well as in case of other infections of the nervous system, intravenous injection of a 40-percent solution of urotropin with a 40 percent-solution of glucose is recommended. The intravenous injection of urotropin is also combined with the infusion of 1-percent collargol and of 0.5-percent trypanflavine solution.

In a number of cases in the acute stage, a 10-percent aqueous sodium iodide solution is introduced intravenously. Such patients are also given convalescent serum (50 cu cm intramuscularly) and autohemotherapy is applied. During the acute period, the patients must be kept in bed.

Great attention must be given to the care of these patients. In the acute period, when the patient is a bed case in the hospital, and it is essential, as in all cases of serious illness, to maintain an atmosphere of quiet and rest around him; loud talking, slamming of doors, rumbling noises, bustling activity, and great haste are inadmissible. The wards should be aired several times per day. In making the bed, care should be taken that the mattress is beaten flat, and that the sheet is dry and not wrinkled. In the morning, thorough toilet of the mouth, nose, and ears is essential. Once a day, the perineal region, the inguinal fold, and the sex organs should be washed. Special attention must be given to skin care and to the prevention of bedsores. The skin of the patient must be rubbed with spirits of camphor or vodka at least twice every 24 hours. He must be placed on the bedpan and the position changed. To prevent festering, the groin and armpits must be sprinkled with talcum powder or smeared with vaseline.

Proper performance of the functions of the intestine and the bladder are very important for the general condition of the patient.

Food should preferably consist of dairy and vegetable products, with sufficient calories and a high vitamin content. It should be soft, easy to swallow, and easily digestible. Weak patients must be fed with great care, and, to prevent exhaustion, food must be administered to them in small portions, with sufficient intervals during the process of feeding. Patients who suffer from increased saliva flow, and particularly those who soil themselves, must be given especially careful treatment. Patients with tremor of the hands or other motor disturbances, who cannot dress and undress themselves, must be helped in making their toilet. If the patient's walk is impaired, care must be taken that they do not fall down. They should be supported under the arms, especially when they walk on stairs.

In caring for patients afflicted with encephalitis, nurses should bear in mind that the patients are badly bothered by their helplessness and worry about the outcome of their disease. For that reason, nurses should be particularly tolerant of them, try to divert them from their gloomy state of mind, and give them faith in their recovery. One should never speak of the patients' affliction in their presence.

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In the chronic stages of the disease, the use of a decoction of belladonna roots, and also of scopolamine solution, gives food but not lasting results. Subjective improvement is noted in treatment by means of warm bath, showers, ultraviolet radiation, and diathermy of the head, as well as injections of massive doses (up to 3 cu cm at one time) of vitamin B1. A very beneficial effect on these patients results from general massage, therapeutic gymnastics, and occupational therapy.

For purposes of prophylaxis persons who have become afflicted with epidemic encephalitis must be hospitalized. Their residence and all objects surrounding them must be disinfected. During the acute period, it is also desirable to disinfect the urine, feces, and other excretions of the patients with a 10-percent calcium hypochloride solution. The patient should be in isolation until the acute period has passed. In all cases of epidemic encephalitis, an emergency report (on a special form) should be submitted to the local health authorities.

## II. TICK-BORNE ENCEPHALITIS

Far Eastern (tick-borne) encephalitis was first described in the USSR and has been thoroughly studied by Soviet researchers (Zil'ber, Levkovich, Chumakov, Shubladze, Solov'yev). The causative agent of the disease belongs to the virus group and is transmitted by ticks.

The pathological process is localized in the brain and the spinal cord. In autopsies, definite inflammatory changes and point hemorrhages are found in various sections of the brain and the spinal cord. The process is localized predominantly in the anterior horns of the upper sections of the spinal cord, in the medulla oblongata, and occasionally in the gray and white matter of the brain cortex. Most cases of the disease occur from May to August (spring-summer encephalitis). Tick-borne encephalitis most frequently strikes persons from 20 to 40 years old.

The incubation period lasts 12-14 days. The acute onset is characteristic for the disease. The temperature curve is characterized by a rapid rise, reaching a maximum on the second day. For 2-3 days, the temperature stays high, and then gradually goes down. Early symptoms of the disease are general malaise, severe headache, nausea, and vomiting. Upon examination (rigidity of the back of the neck) Kernig's and Brudzinski's symptoms are found.

The most prominent place in the clinical picture of the disease is occupied by motor disturbances, convulsions, epilepsy-like fits, paresis, and paralysis. One of the frequent symptoms of the acute period is disturbance of the psyche, which is most frequently expressed by daze and sleepiness, sometimes by complete loss of consciousness; less frequently, fits of excitement are observed. The diversity of the clinical manifestations depends to a large extent on the localization of the process in the nervous system.

The fever period varies between 3-10 days in length. The motor disturbances persist after the fever period; the upper humeral region is particularly affected. In these cases, the patient cannot hold his head in a vertical position (it hangs down passively) and the upper extremities are paralytic. Sometimes, in addition to the limp, paralyzed condition of the upper extremities, there are spastic manifestations in the lower extremities.

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As far as the seriousness of the disease is concerned, the following distinctions can be made:

1. Light cases, in which the fever period lasts 3-5 days, with subsequent rapid recovery.
2. Medium serious cases, with longer duration of the acute period, and good recovery within 1-2 months.
3. Serious cases, with a considerable percentage of fatalities; recovery is delayed, incomplete, and persistent invalidism follows.

There are also galloping forms, in which death occurs within the first few days of the illness.

Tick-borne encephalitis attacks children more rarely than adults. No cases of this disease in children less than 5 years of age have been described.

The clinical picture in children differs little from that in adults. In children, meningeal symptoms predominate, and sometimes Kozhevnikov's epilepsy is observed (between heavyfits there are permanent spasms of some muscle group).

In children, the course of tick-borne encephalitis is more rapid than in adults. The temperature drops on the seventh or eighth day of illness. Just as in the case of adults, the most frequent and permanent aftereffects are limp paralyses of the neck and shoulder muscles.

Cases of tick-borne encephalitis have lately been reported in East and West Siberia, in the Urals, in the Volga region, in the Karelo-Finnish SSR, in Belorussia, and in other places. In these regions, tick-borne encephalitis has a much lighter aspect.

There is no specific remedy for tick-borne encephalitis. The introduction of convalescents' serum, and also intravenous injection of 40-percent urotropin with glucose, are recommended. Intramuscular introduction of vitamin B<sub>1</sub> has also met with some success. Patients must be kept in bed not only during the acute period, but for several weeks afterward.

The general rules of hospitalization, feeding, care of patients, and reporting the disease are the same as in epidemic encephalitis.

A number of authors are of the opinion that special vaccination against tick-borne encephalitis is extremely effective, and recommend prophylactic vaccination of that group of the population which live under conditions involving danger of exposure to tick bites.

Prophylaxis against tick-borne encephalitis should be based on a fight against the ticks. Just before and during the season in which the disease occurs (March to August), widespread sanitary instruction should be given on the role of the tick in the disease and on prophylactic measures. To prevent the ticks from penetrating the body, various authors recommend wearing clothes with fasteners on the collar, sleeves, and legs, coating the body with 1 percent camphor or thymol ointment, and impregnating the clothing with a water-soap emulsion containing up to 5 percent of Preparation K and with an emulsion of turpentine and lysol. A piece of material impregnated with 15-20 percent creolin solution and worn as a scarf is recommended. All those working in the Tayga [Northern forest country] should examine their bodies, underwear, and clothes for ticks twice a day (in the middle of the working period and after work). Ticks which have been discovered must not be squashed with the hand; they should rather be thrown into kerosene or burned. When a tick bite has been found, intramuscular injections of 30 to 50 cu cm of hyperimmune serum must be made two or three times, at intervals of 5-6 days.

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### III. JAPANESE ENCEPHALITIS

Japanese (summer) encephalitis derives its name from the country where it was first discovered. In the USSR, a disease similar to Japanese encephalitis was first discovered in the Far East and described in 1938-39. The causative agent of the disease also is a neurotropic virus. Japanese encephalitis is transmitted by several kinds of mosquitoes and is a seasonal disease. It is observed in Northern Manchuria at the end of summer, and in Primorskiy Kray in the USSR at the beginning of fall.

The pathological process is localized mainly in the brain. Small spot hemorrhages are noted in the gray and white matter of the brain, predominantly localized in the basal ganglia, the pons varolii, and the medulla oblongata. On the other hand, in the spinal cord there is only slight blurring of the general appearance.

The incubation period is 10-15 days.

The disease usually starts with a sudden rise of temperature, from perfect health. In rare cases, general malaise precedes the violent onset of the illness. The temperature curve is not constant. Mostly, a sudden rise is observed, reaching 40-41° C in the first 2 days. The high temperature is accompanied by rapidly accumulating manifestations involving the nervous system. Among the most frequent and constant symptoms are headache with nausea and vomiting, rigidity of the back of the neck, and change of muscle tone. At the beginning of the illness or at its height, paresis and paralysis of the extremities occur. In the acute period, disturbance of the psyche is often observed. The change in the psyche is shown by general stupor and sleepiness; sometimes there is complete loss of consciousness. Frequently, a very strongly expressed state of excitement is noted, which requires keeping the patient in bed by the use of force. Twilight or hallucination states are also observed during the acute period. In such cases, the patients are restless, seize something with their hands, move their fingers, or hide themselves in fright as though pursued by horrible apparitions.

During such fits, the belt, collar, and all other confining articles of clothing must be unfastened, a pillow must be laid carefully under the head, and a knot made in the sheet or robe and placed between the patient's jaws to prevent him from biting his tongue. During the fits, the patient must not be left alone and his movements must be observed, so that he will not injure his hands or arms; pulse and breathing must be watched.

The course of the disease is characterized by its brevity: the fever period lasts 3-12 days. Japanese encephalitis is frequently accompanied by a high death rate and in many cases results in lasting impairment. Full recovery takes place only in some cases. The aftereffects are persistent headaches, paresis, and paralysis. Some patients (more frequently children) who have survived the disease suffer fits similar to those occurring in epilepsy. There is no specific remedy for Japanese encephalitis.

The same treatment is used in cases of this illness as in other acute infectious diseases of the nervous system. In the acute period, special attention should be given to general treatment strengthening the patient (administration of cardiac stimulants). Liberal drinking of liquids, subcutaneous injection of large quantities of glucose or physiological solution, nourishment, and thorough care comprise the measures which should be applied and which differ in no way from those employed in other forms of encephalitis. Prophylaxis consists of hospitalization of the patient, disinfection of the surrounding objects, and above all, fighting the mosquitoes and preventing their bites in infested localities, staying in the open air on warm summer nights must be avoided. As in the case of tick-borne encephalitis, sanitary instruction on the role of the mosquito in the disease and on methods of fighting the mosquitoes should be given before the start of the

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season and at its height (July - October). Special attention should be paid to the destruction of larvae and winged mosquitoes, and also to individual protective measures (use of mosquito netting, installation of canopies and special nets, spraying of repellent solutions). Acute cases of Japanese encephalitis are also subject to registration with the local health authorities.

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