

ing during convalescence may be removed by the application of galvanism. Tincture of chloride of iron is the most useful chalybeate to be given in convalescence. To restore appetite and digestion, tincture of nux vomica will be found efficient, or a combination of dilute phosphoric acid, pyrophosphate of iron, and strychnine may be administered.

HEAT-STROKE AND HEAT-FEVER.

Definition.—Under the terms *insolation*, *coup-de-soleil*, *sunstroke*, and other synonyms, are included three distinct morbid states: acute meningitis, which is comparatively rare; exhaustion from heat, which is common; and true sunstroke, or *thermic fever*,* or *heat-fever*.

Causes.—As the name implies, this disease is due to the influence of excessive heat, certain other conditions being concurrent. It is not necessary, as is popularly understood, to expose the head to the direct rays of the sun. Artificial heat, and the diffused atmospheric heat, will, under appropriate conditions, develop the disease, yet the direct solar rays are more powerfully causative. The habitual consumption of spirits, beer, and alcoholic beverages, unquestionably predisposes to attacks. Excessive fatigue, overcrowding, heavy and close-fitting garments, are also influential factors.

Pathological Anatomy.—The action of the cause is so sudden, and the disease is so rapid in its course, that time is not afforded for the development of structural changes; nevertheless, there are characteristic appearances. The veins and sinuses of the brain are gorged with blood; much venous stasis exists in the lungs; the right cavities of the heart are distended, and the left are contracted and empty. The condition of the heart is disputed. It is generally said to be flaccid, but, according to Wood,† it is firmly contracted immediately after dying, but becomes relaxed as putrefactive changes come on. The blood is fluid, dark, sometimes grumous, feebly alkaline, neutral and even acid in reaction. The red corpuscles appear to undergo in some cases the change known as *crenation*.‡ *Post-mortem* rigidity sets in at once and is very great.

Symptoms.—The acute meningitis caused by heat is the same as that due to other causes, and, as it has been described elsewhere, need not be taken up again. The condition of exhaustion produced by heat has been observed on a large scale by the author,§ and, as it is often

* "Thermic Fever, or Sunstroke," by H. C. Wood, Jr., M.D. Philadelphia: J. B. Lippincott & Co., 1872. Boylston Prize Essay, p. 34. † Ibid.

‡ Dr. Levick, "Pennsylvania Hospital Reports," 1868, p. 373.

§ The author in 1857 accompanied an infantry regiment, about eight hundred men, on the march to Utah from Fort Leavenworth on the Missouri River. The command started on the 18th of July; the heat was great, and large numbers of men fell out exhausted on the first few days. The drinking, dissipated men were the victims almost exclusively. There were no deaths from this cause.

confounded with the true *coup-de-soleil*, should receive some consideration. During the course of some exhausting labor under a hot sun, as marching equipped with blankets and accoutrements, there comes on an increasing sense of weakness; presently the sight grows dim, a rushing noise sounds in the ears, and the individual falls suddenly or sinks down, partially or entirely unconscious. In the most severe cases the man falls suddenly, or stumbles once and then falls unconscious; a shudder or tremor passes over the body, and sometimes a general convulsion occurs as in the syncope from loss of blood. The face is pale, the features are sunken, the pupil is dilated, the surface of the body is cool and perspiring, the muscles are relaxed, the pulse is feeble and quick, and the respirations are hurried and shallow. The senses are obtunded, the perceptions dull and confused, or the consciousness is wholly lost. Under rest and appropriate treatment the symptoms subside in a few hours, and recovery is effected in twenty-four hours.

The attacks of sunstroke are often preceded by prodromic symptoms. The patient experiences frontal tension, headache, and vertigo, and is weak; a strong sense of oppression is felt at the *præcordia*, and there may be nausea and vomiting. When the attack occurs, the patient may pass suddenly or more slowly into a condition of unconsciousness. Notwithstanding the existence of headache, vertigo, and nausea, the laboring man continues at work, and suddenly falls and quickly becomes unconscious. A soldier on the march, or standing at "attention," may undergo the same experience. Another man, feeling the same prodromal symptoms, may be in a position to lie down, and hence, when apparently asleep, passes into unconsciousness. In still other cases the condition of unconsciousness is preceded by delirious acts; the patient tries to escape from, or takes up arms against, an imaginary enemy; or the onset is announced by a peal of wild laughter. Very often there is present an intense desire to micturate. In some fulminant cases, when insensibility occurs, the patient gasps a few times, a shudder runs over the body, and the heart stops. These have been called the cardiac variety of sunstroke (Morehead). In such cases, owing to the sudden death by syncope, there is no time for the development of the symptoms pertaining to the period of unconsciousness. Usually, these symptoms are present, and are about as follows: The face is flushed, deeply suffused, or cyanosed, and the whole surface presents the same appearance; the conjunctivæ are injected; the pupils most frequently contracted, but may be dilated or normal; the breathing is rapid, noisy, and shallow, or it is labored and stertorous; the pulse is very quick and bounding, or it is feeble and quick; the skin is dry and hot, really mordicant, and the temperature of the axilla ranges from 105° to 110° Fahr., most frequently at 108° or 109°. In most cases, there is a condition of complete muscu-

lar resolution, and no movements of any kind take place, all of the reflexes being abolished. In a smaller number, *subsultus tendinum* is present, or restlessness and agitation, or there are clonic convulsions with tetanic rigidity, or epileptiform seizures. In a few cases, petechiæ appear, or hæmorrhages from the mucous surfaces. Involuntary discharge of fæces is the rule.

Course, Duration, and Termination.—The cases of exhaustion from heat usually terminate in health after twenty-four hours, under repose and proper treatment. The prodromal stage of heat-fever lasts a few hours. The fulminant form may end fatally within a few minutes. The ordinary form continues from half an hour to five or six hours. The mode of dying in the fulminant cases is at the heart; of the ordinary form, at the lungs. Those attended with convulsions usually die at the head. In the cases going on to a fatal termination the temperature rises, the action of the heart becomes more rapid and feeble, the conjunctivæ are more injected, the cyanosis deepens, the extremities grow more livid, and the muscular resolution increases in depth. When recovery is about to occur, the surface becomes cooler and is less cyanosed; the respiration deepens, the pulse declines in number and gains in volume, the reflexes are restored, restlessness replaces relaxation, and the convulsive phenomena disappear, if they have occurred. The mortality varies under the varying conditions of the attacks. It is greatest in the old, and in those with damaged heart, and in the obese. The mortality rates as given are vitiated by confounding heat-exhaustion with heat-fever. The mortality may be stated at from ten to fifty per cent.; the latter, however, is nearer the truth in respect to heat-fever. The cause of death being the disorganization of the blood produced by the hyperpyrexia, the failure may occur at the respiratory center, at the cardiac ganglia, or at the lungs.

Diagnosis.—The most important question is the distinction between heat-exhaustion and heat-fever, for on this rest the indications for treatment, and success or failure will depend on the direction taken by our remedial measures. In heat-exhaustion, the surface is pale, cool, and relaxed, the temperature being rather below than above normal, and the insensibility is due to syncope and cerebral anæmia. In heat-fever the surface is suffused or cyanosed, the skin hot, the temperature rising into hyperpyrexia, and the insensibility is due to disorganization of the blood. Heat-fever is to be diagnosticated from the insensibility due to acute alcoholism, to opium narcosis, and to cerebral hæmorrhage. The difficulty is great in differentiating between heat-fever and acute alcoholism, because so many alcoholics fall prey to sunstroke. The history is important. The man with sunstroke has been laboring or walking in the sun or heat, when attacked, and he has had the usual prodromes of the seizure. The thermometer must be invoked to decide; in the case of alcoholism, the temperature is rather below than

above normal. In the further progress of the cases they are differentiated by the gradual recovery from alcoholic insensibility and by the much more speedy termination of the case of heat-fever. The distinction from opium narcosis rests on similar grounds. The minutely contracted pupil, the slow respiration, the cold surface, are the opposite of the rather dilated pupil, noisy and rapid respiration, and high fever of heat-stroke. In the insensibility of cerebral hæmorrhage, the conjugate deviations of the eyes, the slow, full pulse, the labored respiration, the low temperature of the surface, and the preservation of the reflexes in many cases, serve to distinguish this state from heat-fever.

Treatment.—Heat-exhaustion requires rest and stimulants. The head should be low, and the body recumbent. If the patient is able to swallow, he should at once receive an ounce or two of brandy and thirty minims of tincture of opium; or, if unable to swallow, these remedies can be thrown into the rectum, or some whisky and ten to fifteen drops of tincture of digitalis can be injected subcutaneously. It need not be remarked, probably, that bleeding and the application of ice are entirely inadmissible.

Different methods are required in the treatment of heat-fever. The extraordinary temperature, on the persistence of which the danger depends, must be speedily reduced. Rubbing the body with ice, the cold bath, the wet pack, or the cold douche, are the means most effective for this purpose. In India the practice consists in removing the patient to the shade, and at once douching the whole body, stripped, with cold water. This speedily reduces the temperature. The tendency to subsequent elevation of temperature is best obviated by wrapping the patient in the wet sheet. Cold water may also be thrown into the rectum. If depression come on, some whisky or brandy may be given. The subcutaneous injection of quinine may also be practiced to reduce the heat. In cases characterized by restlessness and convulsive phenomena, morphine, hypodermatically, has been used with great success.* Inhalations of chloroform have been administered with equal success under the same circumstances. But the inhalation of chloroform and the hypodermatic injection of morphine may be pushed too far. On the whole, the injection of morphine is the safer expedient, and, the facts show, is very successful in suitable cases. One fourth of a grain of morphine sulphate is a proper dose for a robust adult. As extraordinary tolerance of the remedy is often exhibited under these circumstances, an amount of it may be given which would prove fatal in health. If the convulsions subside, the breathing become more tranquil, and the temperature decline under the use of the injection, it is doing good, and may be repeated, if necessary, in a few minutes, but it is better to await the action of the half-grain until it is clear that a third dose will be necessary. The administration of morphine

* Dr. Hutchinson, "Pennsylvania Hospital Reports," *op. cit.*

subcutaneously is not incompatible with the use of the cold douche, wet sheet, and other measures required to abate the high temperature. The occurrence of sudden depression of the powers of life, the patient passing into collapse, is an unfortunate tendency in some of the cases, which may be attributed to the treatment used. The practitioner should be on his guard, not only to obviate this tendency by the timely use of stimulants, but to avoid reproach.

MIASMATIC DISEASES.

CHOLERA.

Definition.—*Cholera* is an acute infectious disease, endemic in some localities, epidemic elsewhere, and characterized by vomiting and purging of a peculiar rice-water-like fluid, and a condition of collapse and death, or of a reaction from collapse and the development of a typhoid state.* It is known also as *epidemic cholera*, *Asiatic cholera*, *malignant cholera*, etc.

Causes.—The etiological factors concerned in the diffusion of cholera are very complex. Is there a cholera-germ? The facts thus far accumulated render it highly probable that cholera is propagated by a minute organism—according to Koch, a *bacillus*, the *comma bacillus*. Although some eminent bacteriologists refuse to accept this view, the weight of testimony is in its favor, and as the crucial test of cultivation, and the production of a cognate disease in animals, is not wanting, we can hardly refuse our assent, until, at least, another organism is finally proved to be the morbid agent. When the first epidemics of cholera started on their march around the world, they pursued a general direction from east to west, following the routes of commerce, and from one great center of population to another; but this course was not inevitable from the nature of the poison, and it is now known that the disease pursues no defined course, and, in fact, spreads in all directions, according to the freedom of communication. It is conveyed by caravans, by ships, in clothing, baggage, and other effects, by streams of water, by air, etc. It is not contagious, in the common acceptance of that term. Physicians and attendants in cholera hospitals are not more exposed than others, during the existence of the epidemic, unless a local source of infection occurs. The author had charge of the cholera hospital in Cincinnati during the epidemic of 1866, and not only visited the wards several times daily, but made a number of autopsies, and on several occasions was wounded, without

experiencing the first symptom of the disease. The assistant physicians and attendants were equally exempt. The dead bodies of cholera subjects apparently possess no infective property. The bacteria of decomposition destroy the disease-germs of cholera. The morbid material or germ is more certainly conveyed in the moist state, and some preparation or transformation must be undergone before it becomes active. As it leaves the person of the sick it does not appear to have toxic power, but acquires this subsequently. Hence cholera is not communicated directly from one person to another: an intermediate condition of preparation is necessary. Hence the importance of the superficial water-supply (the *ground-water* of Pettenkofer), and of certain geological formations. The character of the soil best adapted to the nurture of cholera-germs, because retentive of the surface-water, is alluvium, light and porous, resting on an impervious clay subsoil. Malarial regions are generally very favorable to the growth of cholera-germs. When the ground-water is low, the germs are produced in greater abundance than when it is high. Cholera is always spread rapidly when the drinking-water is supplied from the surface drainage, and hence is rich in organic matter. The records of cholera epidemics are full of most striking examples of this truth. The excretions of cholera patients, thrown on the ground, or into superficial privy-vaults, quickly reach the ground-water, multiply rapidly, and soon the sources of water-supply, the superficial wells and streams, become contaminated. Hence it is that one of the principal sources of cholera infection is the water-supply. When an epidemic influence prevails, not all exposed to the poison contract the disease; great differences in the individual susceptibility are found to exist. The hygienic influences affecting the individual are highly important. Excesses in venery, in spirit-drinking, late hours, and an irregular life generally, bad air, and moral depression and fear of the disease, exercise an unfavorable influence. Males are more apt to have cholera than females, and infants are less susceptible. The mortality is less among children than among adults, and is greatest between twenty and thirty. Although it is true that heat favors the spread of cholera, and that the greatest mortality is during the hot season, yet it does prevail during the winter; a notable example was afforded by the Russian epidemic of the winter of 1830-'31. The disposition to an attack of cholera seems greatest in the early morning. A hot, moist, and stagnant atmosphere is especially favorable to the development of the epidemic influence. A light rainfall, followed by a warm mist, the air being still, was the condition of the atmosphere when the cholera assumed its most severe phase in the Cincinnati epidemic.* An ordinary epidemic, under the circumstances

* A "norther," with rain, preceded a fearful outbreak of cholera among the United States troops (Eighth Infantry) at Lavacca, Texas. Reported by Dr. N. S. Jarvis, U. S. A., Fenner's "Southern Hospital Reports," vol. i, p. 436, *et seq.*, 1849.