

Original Articles.

CASES OF HEAT-STROKE OBSERVED IN THE SUMMER OF 1892.¹

BY WM. W. GANNETT, M.D.,
Visiting Physician, Massachusetts General Hospital.

THE unusual heat at three periods in June, July and August of last summer led to a number of cases of heat-stroke. Those here reported occurred in the services of Dr. Whittier, Dr. Cutler and the writer, at the Massachusetts General Hospital.

Through the kindness of Drs. Whittier and Cutler their cases are given with those of the writer.

Two of the cases have been admirably reported in detail by Dr. E. C. Stowell in the *Boston Medical and Surgical Journal* for November 10, 1892. A brief résumé of these cases is included in this series.

Extreme heat may act upon man in one of two ways, either in producing what is known as heat-exhaustion, or causing what, for the lack of a better name, has been called heat-stroke.

The contrast between the two conditions, when typical, is very striking. In heat-exhaustion the patient is feeble, pale; the skin is cold and clammy; the pulse scarcely perceptible; respiration shallow and quickened. Occasionally there is fainting, more commonly the mind is clear. The temperature is at or below the normal. The picture is that of marked depression of the vital powers. It may well be due, as suggested by H. C. Wood, to a vaso-motor paresis, with determination of blood to the abdominal organs.

In heat-stroke, on the contrary, the symptoms are far more active. The onset may be very sudden without prodromal symptoms, the patient being struck down as in apoplexy. More commonly there are earlier symptoms of pain or discomfort in the head, or dizziness; oppression in breathing; nausea; sinking sensation in the epigastrium; disturbances in the color sense, objects appearing colored red, blue or otherwise. Seen at the time of the stroke, the patient will be found, in most cases, to be wholly unconscious; though occasionally he can be partially aroused. The skin is very hot, and usually dry, though it may be moist. The pupils are in most cases contracted and do not react. The respiration is noisy, especially the expiration, which is sighing or groaning or stertorous. The pulse varies, sometimes full and regular; again, barely perceptible. There is often muscular twitching and not infrequently muscular spasm, the arms being flexed and crossed over the chest without resting upon it, the legs being drawn up. A maculo-papular eruption is now and then seen.

Death may result almost immediately in the severe forms, or it may be delayed and occur later from respiratory paralysis or circulatory disturbance, usually with convulsions. If recovery occurs, the temperature falls, the pupils relax, and the patient regains consciousness. After the temperature has returned to normal there is often a relapse with rise in temperature. If recovery occurs, the individual often has cerebral distress or pain when the weather is only moderately warm. In some cases persistent headache is present. Recurrence of heat-stroke is likely.

In the study of heat-stroke the questions which naturally suggest themselves are:

What is the nature of the process?

¹ Read before the Boston Society for Medical Improvement, January 9, 1893.

What are the conditions under which it occurs?

Why are some affected while others in the same environment escape?

The literature of the subject has kept pace with the evolution of physiology and pathology.

The older ideas are too crude for consideration.

At the present time it seems fair to assume that too great heat in the body is the cause of the symptoms. But what is the cause of the too great heat? The fact of the greatly increased temperature of the body, as indicated by the thermometer, shows that there is either a greater heat-production with a normal loss by radiation; or that the dissipation of heat is less than normal, the production remaining the same; or that there is a combination of the two conditions. By either of the three alternatives the bodily temperature will rise. Farther than this it is hardly possible to go at present, while the subject of heat-production, heat-dissipation and the heat-regulating power is so imperfectly understood.

The theory of Tscheschichin of a heat-centre in or above the pons, which H. C. Wood considers he has proven, while probable, is not universally accepted; the question also of a heat-producing or heat-regulating mechanism in the medulla or below, is also not determined; and until this matter is better understood it seems to the writer that one should be content with the idea that too great accumulation of heat is the condition, resulting from some disturbance in the heat-regulating mechanism and leading in turn to circulatory and respiratory disturbances.

The post-mortem appearances give practically no help in deciding as to the nature of the affection; for beyond general engorgement with blood and occasionally minute hemorrhages the organs show nothing.

As to predisposing causes, there are several to be considered. Foreigners from cool climates are more likely to be affected. In the writer's series all but one were foreigners. This fact, often noted, has been decried by some on the ground that foreigners do the work likely to expose them; but natives are as much exposed, and are not so frequently affected.

Again, the fatigue consequent upon prolonged exertion of the muscular or nervous systems is undoubtedly a factor; especially is this apparent in soldiers after long marches.

The depression due to several days of continued heat also comes under this heading.

The question of the previous abuse of alcohol is one about which there is a wide difference of opinion. Many think it an important predisposing cause; but the English physicians in India, whose experience in heat-stroke is considerable, think it unimportant. In the writer's series, so far as the habits could be learned, it was unimportant.

The abuse of ice-water, while undoubtedly tending to disturb the gastro-intestinal tract and so interfere with the nutrition of the individual, has not been shown, so far as the writer is aware, to favor heat-stroke.

As to the cause of the stroke, it will appear self-evident to say that it is due to exposure to excessive heat.

Exposure to the direct rays of the sun is not necessary, nor does it always occur in the day-time. Many cases have been reported, especially in India, as occurring in the night.

High temperature with much moisture in the air is far more likely to lead to heat-stroke than an even higher temperature with a dry air.

Those working in confined moist air, as in laundries and in certain rooms in sugar-refineries, are more likely to be affected than are those exposed to dry heat. In the case of sugar-refineries, men working in what are known as bag-rooms, where filtering bags are washed in a steaming atmosphere of about 90°, suffer far more from heat than do those working in wagon-rooms where, although the temperature is never allowed to fall below 120°, the air is very dry.

In connection with the cases to be reported, the writer had the previous histories taken where it was possible, in the hope that something as to causative relation might be learned.

During the afternoon the temperature rose to 102.8°; but a bath at 70° for thirty minutes reduced it to 100.6°. At 11 p. m., eleven hours after the seizure, he became clear in his mind; went to sleep; slept well; and on the second day after entrance, left the hospital well. A month later he wrote that he was perfectly well.

The case is remarkable in having recovered after so high a temperature — 110° at the police-station, 107.8° on entrance to hospital.

CASE II. T. C., laborer, age twenty-four. Native of Ireland; living in East Cambridge. Previous habits good. Said by the police-officer who brought

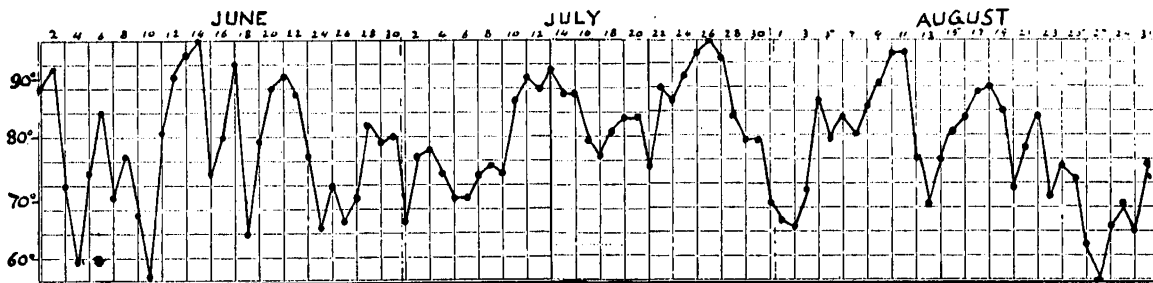


Chart showing maximum daily temperatures during June, July and August, 1892. From figures in the official records of the United States Weather Bureau in Boston.

Date.	Temp.	Cases.	Recoveries.	Mean Humid.	Date.	Temp.	Cases.	Recoveries.	Mean Humid.
June 12.	90°	0	0	62	July 24.	90°	0	..	60.5
13.	94°	0	0	59	25.	94°	0	..	72.5
14.	96°	1	1	65.5	26.	96°	4	3	61
15.	74°	1	1	54.5	27.	93°	3	1	47
16.	80°	0	..	62.5	Aug. 10.	94°	2	1	65.5
17.	92°	1	1	70-87	11.	94°	0	..	81

Table showing maximum temperature, mean humidity, number of cases of heat-stroke and recoveries during the three hot periods in the summer of 1892. Temperature and humidity from the records of the United States Weather Bureau in Boston.

CASE I. A. P. G., age thirty-two, cook's assistant. Native of Scotland; lives in Boston. Previous habits excellent. Had been in Boston four months, working in a basement restaurant in Court Street.

For two days previous to entrance to hospital he had been dizzy. On the morning of June 14, 1892, dizziness again came over him and he tried to fight it off. At noon he left the hot kitchen to get a breath of air. He remembered walking on Tremont Street, but nothing more. He fell unconscious in front of the Tremont House, two blocks from where he worked. He was taken to the station-house by the police where it was found that his temperature was 110°. Ice was applied to his head, and he was taken at once to the hospital, reaching there at 1 o'clock. He was completely unconscious; skin hot and dry. Pupils moderately contracted, reacted to light. Rectal temperature 107.8°, pulse 110, respiration easy. After rubbing with ice for fifteen minutes the pulse went up to 160, weak, and the expiration groaning; temperature 105.5°. Head spasmodically turned to right. Atropia was given (one-sixtieth). Half an hour later, during which the rubbing with ice was continued, the temperature fell to 99°. Muscular spasm increased; the arms bent and rigidly held across the chest; the legs drawn up and flexed on abdomen. Pulse became very weak. Respiration moaning. A sixtieth of strychnia given subcutaneously. For a few moments he was quiet, and then followed a severe spasm of muscles and of respiration. Twenty minutes later he became quiet again.

him, to have been working in a sewer. He was seen staggering on the railroad track, and fell before being reached.

Patient was received at the hospital at 4.15 p. m., June 15, 1892, in a wholly unconscious condition. Skin hot and dry. Pupils contracted, not reacting. Temperature 115°, highest thermometer would register; pulse irregular in force and rhythm; heart-beat 146. Rubbed all over with ice by three, and at times four, men for twenty-five minutes. Temperature then 104.6°; pulse irregular and much weaker. One-sixtieth of a grain of atropia was given. Ten minutes later temperature was 100°, pulse 132; not improved in strength. One-sixtieth of strychnia was now given. Arms in spasm, folded across chest. The rubbing with ice was stopped after an hour, the temperature having fallen to 90.3°, the pulse remaining the same. One-sixtieth of strychnia was given. As he was quite dusky, oxygen was given for ten minutes, followed by improvement in respiration. The legs now became partially drawn upon abdomen. Three hours after entrance he became delirious, and fought violently. The head being hot and the temperature 100.2°, he was put into a bath at 70° for fifteen minutes. At 11 p. m., seven hours after entrance, he became rational, and soon went to sleep. Recovery was complete, patient leaving the hospital on the second day after entrance.

CASE III. M. C., laborer, age twenty-one, single. Born in Ireland; living in Boston. Not a drinking man. Had been working only one day in gravel-pits

at Cottage Farm. Brought to hospital in ambulance at 2.30 p. m., June 17th. Stupid, but could be aroused. Skin hot. Rectal temperature 103.8°; pulse 104; respiration 24. Pupils react. Head rubbed with ice for half an hour, and then a bath of 70° given for five minutes. Temperature then 103.6°; pulse 80; respiration 14. For an hour the head was rubbed with ice. Temperature then was 103.8°; pulse 80; respiration 20. The whole body was then rubbed with ice two or three times. Temperature then was 98.3°; pulse 80; respiration 20. The pulse was of good strength throughout. Urine, normal color; acid; 1,015; no albumen; no sugar. At 3.40 he was in condition to be sent to the ward. The next day he was clear in his mind, with normal temperature, good appetite, no headache.

He was discharged on the 20th, well.

CASE IV. F. M., ice-man, age twenty-seven. Born in Ireland; living in Boston. Patient brought to hospital at 2 p. m., July 26th, having been picked up unconscious in the street.

Well developed and well nourished. Skin very hot and dry. Face flushed. Pupils contracted. Respiration short and jerky. Slight twitching of muscles of arms and face. Temperature 115°; pulse regular and of good strength.

Ice was applied to the head and body, reducing the temperature at 3 p. m. (one hour after entrance) to 101°. Pulse became poor; ice was discontinued, and brandy given subcutaneously. At 3.30 p. m. the convulsive movements became more marked, clonic in character, and involving the whole body. Also several involuntary defections. Ice-bag applied to head. Brandy given subcutaneously every fifteen minutes. The convulsions became so extreme that he was given a few whiffs of chloroform every half-hour, which controlled them wholly.

Patient did not regain consciousness. Pulse failed rapidly. Respiration became stertorous. Temperature rose to 105°, and patient died at 12.40 a. m. on Wednesday, eleven hours after entrance. Urine pale; acid; specific gravity 1,020; trace of albumen; no sugar. The sediment contained a few free blood-corpuscles; hyaline and fine-granular casts; a few casts with blood-corpuscles adherent; uric-acid crystals.

CASE V. Coal-heaver, age thirty-five. Born in Austria. Patient was brought to hospital at 4 p. m., July 26th, having been picked up unconscious.

At entrance he was partially conscious. Skin hot and moist. Pupils contracted. Twitching of arms and legs. Respiration quiet and slow. Temperature by rectum 102.5°

Application of ice to head and body reduced the temperature to 99°. Patient then began to shiver, and goose-flesh appeared; so was given an ounce of brandy. Pulse became full and strong. Slept till midnight, when he became restless and got out of bed, but was quieted by one-eighth of a grain of morphia.

Next day he was comfortable, and was discharged well. Urine acid; specific gravity 1,017; slight trace of albumen; no sugar. Sediment contained fresh blood, hyaline and granular casts, with fresh blood adherent.

CASE VI. J. S., laborer, age forty-four. Native of Ireland; living in Boston. Brought to the hospital at 5.30 p. m., July 26th, having been found in an unconscious condition in a stable where he had been mixing mortar.

At entrance, patient was stupid, but could answer questions. He had been faint during the afternoon, and had drunk large quantities of water. About 5 o'clock he had a feeling as if struck on the back of the head with a brick, and remembered nothing after that.

Patient was well developed and nourished. Pupils contracted. Skin very hot and moist. Maculo-papular eruption over whole of body. Temperature, by rectum, 107°; respiration quiet. No twitching.

Application of ice reduced the temperature in an hour to 100°. After this ice-bags to the head alone were used. The pulse was good. He became fully conscious. Slept all that night; and the next day was practically well, there being no headache or dizziness.

The following history of his antecedents was obtained. Family history negative. Had been in the habit of taking two or three glasses of whiskey daily. Eleven years ago he had a sunstroke, and was laid up for two weeks, and did not regain strength for three months. Five years ago he had a sunstroke, and was laid up three weeks. Ever since then he has been easily affected by the heat, and more or less prostrated during hot weather.

Two days before present attack, the intense heat caused *malaise*, anorexia and headache. On day before attack, he felt too weak to work. The day of the attack, though not feeling better, he went to work. He felt very hot, but did not sweat. He worked indoors, and drank a large quantity of ice-water during the morning. He ate a moderate dinner and drank one glass of brandy.

He became constantly weaker and more miserable, with headache and blurring of the vision. At 5 p. m. he became dizzy and fell unconscious. Urine very pale; acid; specific gravity, 1,005; slight trace of albumen; nothing abnormal found in the sediment.

CASE VII. J. N., stableman, age thirty-four. Native of Ireland; living in Boston.

Sent to hospital by Dr. G. G. Sears, July 26th. He had been working in a stable, and had drunk during the day a large amount of ice-water. In the afternoon he felt dizzy and faint, and at 5 o'clock became suddenly unconscious. Temperature at the time of attack not known.

He was treated with the ice-pack by Dr. Sears, and consciousness returned in about an hour. He was then taken to the hospital. At entrance the skin was hot and moist. Maculo-papular eruption on the body. No twitching of the muscles. Pupils moderately dilated. Ice was applied, and the temperature soon fell to normal. He soon fell asleep, and slept quietly. The next day, although weak, he was practically well; wholly free from headache.

The history of the patient, previous to the attack, is as follows: He had always been well, and had not abused alcohol. The day before the attack, as well as on the early morning of the attack, he had felt well, though sweating a great deal. At 7 a. m. he drank a glass of milk, and immediately vomited. After this he felt weak and miserable, but kept at work in the stable, not exposed to the sun. He sweat but little on the day of the attack, though he drank a large amount of ice-water during the morning, and ate a good dinner. At two o'clock he took two glasses of whiskey to "brace him up." Later in the afternoon he became dizzy, and fell, unconscious, at 5 p. m. Bowels had moved freely in the morning. Urine acid; 1,020; slight trace of albumen; no sugar. Sediment

showed uric-acid crystals and an occasional hyaline cast.

CASE VIII. H. P., teamster, age thirty-three. Born in Maine; living in Boston.

Patient brought to the hospital at 9 A. M., July 27th, unconscious, having lost consciousness half an hour previous to entrance.

He was well-developed and nourished. Skin cool and dry. Pupils moderately dilated, not reacting. Respiration shallow and jerky. Temperature, by rectum, 100.2°. He was put to bed, with ice at the head. In half an hour breathing became quieter, and he partially regained consciousness. Temperature 99°, by axilla, though the skin felt hot and dry. At 11 A. M. he could talk coherently. There was headache for two days, when he left the hospital well.

The past history of this case is unimportant. His habits were good. The day before the attack he worked, although much debilitated by the heat. He had eaten but little for two or three days. In his work he is much exposed to the sun. On the morning of the attack, after going to work, he became very hot and weak, but did not sweat. He drank much ice-water and one glass of whiskey. He became dizzy, blind; and lost consciousness at 8.30 A. M. Urine alkaline; specific gravity 1.028; trace of albumen; no sugar. In the sediment were blood corpuscles and a few hyaline and granular casts; uric-acid crystals; oxalate of lime and triple-phosphate crystals.

CASE IX. P. D., harness-cleaner in a stable, doing night-work; fifty years old; Irish.

Brought to the hospital at 7 A. M., Wednesday, July 27th. Said to have been feeling mean all night, and to have drank large quantities of ice-water. Fell unconscious in the stable at 6.30 A. M.

At entrance he was unconscious. Skin dry. Pupils contracted, do not react. Respiration labored; pulse of fair strength; temperature 109°. Rubbed with ice all over, except cardiac area. At 8 o'clock, half an hour later, the temperature was still high, 108°; pulse weaker. One-sixtieth of strychnia, subcutaneously, stimulated circulation for a short time; then the strychnia was repeated, and one-sixtieth atropia given for the pulse before 9.30. The rubbing with ice was kept up continuously until temperature had fallen to 101°. Then put on a dry bed. Circulation poor, lips cyanosed; groaning expiration. Pupils somewhat dilated, but do not react. Answers to name when loudly called. In about fifteen minutes, although the skin was cool and the head was again rubbed with ice, slight convulsions came on which increased in severity; he could be aroused; the cyanosis became marked; and he died at 10 A. M., three and a half hours after the seizure.

CASE X. J. C., age forty-five, freight-handler. Native of Ireland; living in South Boston.

Brought to hospital in police ambulance at 7 P. M., July 27th. Said to have fallen on Albany pier in South Boston at 6 P. M. Nothing could be learned of his earlier history or habits. A large, well-developed man; absolutely unconscious; labored respiration; tracheal râles; eyes open and glazed; rectal temperature 110°; pulseless. He was given at once one-sixtieth of a grain of strychnia subcutaneously, and was rubbed with ice all over. Pulse soon reacted, but was thready and weak. Twenty minutes later, temperature, by rectum, 109°; pulse somewhat fuller. The head was packed in ice, and a sixtieth of atropia given. At 9.30, tem-

perature 99.4°; pulse weak, requiring another sixtieth of atropia; respiration labored. At 10, temperature 96°, by rectum; pulse very weak. Convulsions came on; and he died at 11 P. M., without having regained consciousness, five hours after seizure.

CASE XI. P. D., laborer, age thirty. Born in Ireland; living in Boston. Patient was brought to the hospital by the police, August 10th, having fallen unconscious while stoking boilers in a large slaughtering establishment.

At entrance he was unconscious, cyanosed. Pupils small, not reacting. Skin hot and dry. Pulse rapid, but full; difficult expiratory respiration; temperature, by rectum, 110.1°. Patient was at once stripped, and the whole body, except over the heart, rubbed with ice. After half an hour the temperature fell to 108°. The pulse was smaller and weaker. One sixtieth of a grain of strychnia was given subcutaneously. In another half-hour the temperature was 105°. The pupils dilated; respiration became slower and more noisy; goose-flesh; occasional motion of the arms; vomiting and involuntary dejections.

A half-hour later temperature was 100.2°; pulse of fair strength, expiration very noisy; cyanosis increasing; occasional contractions of arms and legs. The ice was removed, and patient put in a dry bed, and oxygen, in a steady stream, given, which relieved the dyspnoea and cyanosis.

Temperature again arose to 102.8°, and the skin became hot and dry. Ice-bags were applied to the head; the forehead was rubbed with ice; and oxygen was given constantly. At 8 P. M., respiration was normal, though consciousness had not returned. At 11 P. M., nine hours after entrance, consciousness returned, though he was somewhat dazed. Urine acid; slight trace of albumen; no sugar; in the sediment were hyaline and granular casts; no blood.

The patient made a good convalescence, with a temperature of 101° the next morning; 100° the next evening; and then a gradual fall to normal. It was afterward learned that the patient had, four weeks previously, been discharged from the Worcester Insane Asylum, having been cured of what is stated in the record to have been alcoholic insanity. He had formerly been a hard drinker.

CASE XII. An unknown man, a coal-shoveller, aged about forty-eight, was brought to the hospital by the police at 4 P. M., August 10th. Said to have fallen on the street. He was unconscious. Skin hot and dry. Temperature 109.1°. Pulse not to be felt at the wrist. Heart-sounds very feeble. Respiration gasping, with rattling expiration. One-sixtieth of strychnia, and oxygen in a constant stream were given.

He was rubbed with ice, the head being rubbed with care; and ice was packed about the neck. The respiration improved, and the pulse could be felt at the wrist, though weak. One-sixtieth of atropia was now given. Temperature fell to 101°, and the general condition improved; so the rubbing with ice, except of the head, was discontinued, and the oxygen kept up. Soon after, the expiratory dyspnoea increased. At 7 P. M. he had a slight convulsion, which was followed by severer ones; the pulse failed, and he died at 8 P. M., without having regained consciousness, four hours after entrance to hospital.

In this series of twelve cases there were four deaths; a mortality of one-third or thirty-three and a third per cent.

In the fatal cases death resulted in three and one-half hours; four hours; five hours; eleven hours.

Eleven were foreign-born; one was a native of Maine. Two worked where there was artificial heat; one in a basement restaurant-kitchen, the other in a boiler-room.

Only two are known to have been exposed to the sun's rays.

Two were coal-heavers; but whether working in the hold of a vessel or on a staging is not known. The temperatures in the fatal cases were 115°, 110°, 109.1°, 109°; in the recoveries, 115°, 110.1°, 110°, 107°, 103.8°, 103° (in axilla), 102.5°, 100.2°.

In the fatal cases the lowest temperatures were: in the case of 115°, 101°, rising to 105° before death; in the case of 110°, lowest 96°, but ice stopped before it had reached 99.4°; in the case of 109.1°, lowest 101°; in the case of 109°, lowest was 101°.

In the fatal cases there was no return to consciousness. In the recoveries consciousness returned in about an hour in four cases (the term "about" is used because the transition was so gradual); in three hours; in seven hours; in nine hours; and in eleven hours.

In four cases there was a secondary rise of temperature, one of the cases ending fatally.

In the four fatal cases there were severe convulsions.

In the eight cases with recovery, two showed spasmodic contractions of muscles, and two muscular twitching.

In six of the cases the skin was very dry at the time of entrance; in three cases it was moist; and in the remaining three cases no record was made. The dry condition of the skin is of interest, as it shows that one important means of heat-dissipation, through sweating and evaporation, was absent.

In the three cases in which a detailed history of the patient's condition previous to the stroke was obtained, it was found that in all those there had been no sweating for a day previous to the attack, although earlier there had been sweating.

The urine was obtained in five of the cases. In one it was normal. In four it contained a trace of albumen; and in three of these four cases the sediment contained hyaline and granular casts and a few blood-corpuscles. One of the fatal cases was among these. In the other three fatal cases no urine was obtained. In the writer's opinion, this condition of the urine was the result of the congestion of the kidney, with a certain amount of granular degeneration.

In regard to prognosis, it may be said that the deeper the coma, the higher the temperature, the greater the respiratory and circulatory disturbance the greater the nervous symptoms of twitching, spasm or convulsions, the worse is the outlook. *Per contra*, the lesser the intensity of the symptoms, the better the chance of recovery. Partial return to consciousness, relaxation of the pupil, lowering of the temperature and quieting of the respiration, are encouraging signs. Fall in the temperature, with persistent deep coma, is an unfavorable sign.

Treatment: as the symptoms are directly or indirectly the result of the increased heat in the body, the first and foremost indication is the reduction of the temperature.

No time should be lost. The patient should be stripped, laid upon a table, if one is at hand, and rubbed with ice over the entire body. If ice is not to be obtained, he should be placed in a bath as low as 70°,

and the water cooled still more, if cooler water can be obtained. Goose-flesh, shivering, or fall in the temperature to nearly normal, are the indications for stopping the ice. The patient should then be put on a dry bed; and if there are signs of circulatory disturbance, a sixtieth or fiftieth of strychnia should be given subcutaneously, and repeated if necessary. If there is much respiratory disturbance, as manifested by expiratory dyspnoea, and oxygen can be obtained, it should be given.

Twitching or spasms or slight convulsive movements are often controlled by a subcutaneous injection of morphia; but if there are severe convulsions, a few whiffs of chloroform will be found most satisfactory.

The temperature should be carefully watched for some hours, so that, in case of a secondary rise, a bath may be given or the ice applied. In general, it is desirable to keep ice-bags to the patient's head for several hours after he has been put to bed.

After recovery the patient should be warned of the danger of future exposure to high temperature.

Cases have been reported in which for a long period after heat-stroke, headache and epileptic convulsions have occurred. These symptoms may, of course, be due to a meningitis or some other cerebral disturbance caused by the heat-stroke; but inasmuch as the reported cases have done well under iodide of potash, and not improved under other means, the writer cannot but feel that there may have been a syphilitic element in the cases.

In the use of antipyretics, other than cold, the writer has had no experience. Antipyrine is recommended by so high an authority as H. C. Wood; but when one considers the depressing effect upon the heart of this drug, it would seem desirable to be cautious in its administration. If cold bathing or ice were inaccessible, of course it should be used.

EXPLORATORY OPENING OF THE TYMPANUM AND SUBSEQUENT OPERATIONS IN THE MIDDLE EAR, WITHOUT GENERAL ANÆSTHESIA.

BY CLARENCE J. BLAKE, M.D., BOSTON.

In view of recent advances in the surgery of the middle ear¹ and especially in those cases of chronic, non-suppurative middle-ear disease where operation is undertaken for the improvement of hearing and in which the exact determination of the character and location in the sound-transmitting apparatus of the obstacles to the passage of the sound-wave is a matter of difficulty, the question of some method of exploratory operation which shall avail of the intelligent participation of the patient, has become a matter of considerable importance.

In a series of experiments on the progressive growth of the dermoid coat of the membrana tympani made several years since,² it was found that the movement outward from the centre of the membrane at the tip of the malleus toward the superior and posterior periphery was slowest in the inferior third of the posterior

¹ B. Gomperz: Ueber die Entwicklung und den gegenwärtigen Stand der Frage von der Exzision des Trommelfelles und der Gehörknöchelchen. Monatschrift f. Ohrenheilk., January, 1893.

² Stotter: Beitrag zur operativen Behandlung der Schwerhörigkeit in Folge von Schallleitungshindernissen. Monatschrift für Ohrenheilkunde, August, 1892.

³ C. J. Blake: Progressive growth of the dermoid coat of the membrana tympani. American Journal of Otology, vol. iv, p. 266.