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ON INSOLATIO, SUN-STROKE,

OR

COUPE-DE-SOLEIL.

BY

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ON INSOLATIO, SUN-STROKE, OR COUP-DE-SOLEIL.

As so many of our fellow-countrymen have of late died from the effects of sun-stroke, the following remarks, based on the observations of one who had opportunities of seeing many such cases during Sir Hugh Rose's summer campaign of 1858 in Central India, may not be unacceptable to those in this country who have never witnessed the direful results of direct exposure to a tropical sun.

Everyone knows the influence of high atmospheric temperature in stimulating the organic, and, if continued for some time, in depressing the animal functions; yet many who have not had opportunities of personal observation may not be aware of the distressing effects of heat when it acts as an exciting cause of sudden attacks of illness. Exposure to the influence of a tropical sun may give rise to various minor forms of illness of a febrile and more or less lingering character, but on these affections it is not my purpose to write.

The terms Insolatio, Sun-stroke, or Coup-de-soliel,

are applicable to those cases only in which an individual is seized with sudden, alarming illness, and in which life is placed in immediate jeopardy, the patient exhibiting some one or other of the combinations of symptoms to be afterwards described. The object I have in view may perhaps be best accomplished by classifying the following remarks under the successive heads of—

1st. The various forms which the attack may assume; or, in other words, the different degrees of intensity of the affection; and the symptoms characteristic of each form.

2nd. The predisposing causes of this affection.

3rd. The *post-mortem* appearances, and the conclusions deducible from them as to the nature of the disease.

4th. The treatment most successfully adopted in these cases.

Amongst the many cases of sun-stroke which came under my observation, three different forms of attack were observable—

In the first and speedily fatal form, the individual has no premonitory warning of the impending evil, or, if he has any, it is of momentary duration, for he immediately falls down insensible, quite unconscious of all outward impressions, makes a few hurried, gasping respirations, and instantly expires. The examples I had opportunity of seeing of this most rapidly fatal form of the disease, occurred during direct exposure to the rays of the sun. The redness and heat of the surface of the body, the per-

fect unconsciousness, and the gasping respiration, are striking features in this sudden and fatal form of seizure.

In the second form of attack the sufferer has an unusual and an extremely painful feeling in his head; a distressing sense of bursting and burning in his eyes, accompanied with giddiness and confusion of vision; a most overpowering sensation of constriction in the chest, with greatly oppressed respiration; great heat of the surface of the body; a dark red, almost livid, colour of the skin, and an alarming sense of general opression and exhaustion. On looking at the patient, the impression formed was, that the chief suffering was in the chest, and patients labouriug under this form complained most of the symptoms referable to the chest and the breathing, and in many instances described them as almost insupportable.

If proper means be instantly adopted and zealously pursued, consciousness may not be lost, and the symptoms may be removed and leave the patient to all appearance comparatively well; or they may increase in severity, and merge into those of the third form, the phenomena of which are the following:—

The sufferer complains of violent pain in the head and eyes, of giddiness and confusion of sight, of a most painful feeling of suffocation and constriction in the chest, of extreme debility, especially in the back and limbs, of intense thirst, and of heat in the epigastrium, all which symptoms rapidly increase in severity until the supervention of insensibility, which too often most rapidly ensues.

If called in early, the medical attendant usually finds his patient in a state of extreme prostration, and affected with convulsions, vomiting, a burning hot skin, a very contracted pupil, an excessively suffused conjunctiva, and a rapid and feeble pulse. In many cases, shortly after the seizure, priapism and emission of semen take place. The respiration in all cases is hurried, imperfect, and gasping; and, before insensibility comes on, the sufferer is often in a restless, alarmed, and agitated state, not unlike that observed in persons labouring under delirium tremens. The patient remains in this condition for a longer or shorter time according to circumstances; but before the scene closes, the pupil becomes so contracted as to be almost obliterated; the conjunctiva more and more suffused; the respiration, at first hurried, imperfect, and gasping, becomes slower and rather stertorous; the convulsions and vomiting cease, and the sufferer lies perfectly motionless, it may be, in a state of low muttering delirium, but completely insensible to all outward impressions. The skin retains its burning heat, but becomes rather clammy; the sphincters relax, the rapid, feeble pulse becomes more and more weak, and at last the patient expires.

Such are the symptoms when the affection ends fatally; but the case may result in fever, or the individual may have a severe attack, and he may ultimately recover; but after the characteristic symptoms have been removed, he usually continues to suffer, for a longer or shorter time, from pain in the head and eyes, from giddi-

ness and confusion of vision, from ringing in the ears, and from pain in different parts, especially in the back and limbs; all which symptoms are generally of a more or less decidedly periodic character.

The subject of coup-de-soliel may therefore suddenly expire, or he may succumb after a longer or shorter time, or his case may merge into fever, or he may ultimately get well, after experiencing for some time such symptoms as I have attempted to describe.

The first time I had an opportunity of seeing a case of sun-stroke, an impression was immediately made on my mind that I had never seen a person affected with the same disease, or with one similar to it. The great majority of the cases of sun-stroke which I saw occurred during direct exposure to the rays of the sun, but some cases commenced in the shade. Examples of all the forms of the complaint commencing during direct solar exposure were numerous, but I did not see any case of what I have described as the most rapidly fatal form, in which the seizure occurred while the person was in the shade.

Having now come to the consideration of the predisposing causes, it may be stated that whatever tends to diminish the vigour of the constitution may act as a predisposing cause. Insufficient rest, undue labour, intemperance, excessive fatigue, depression of spirits, debilitating influences of every kind, are unquestionably predisposing causes of this affection. A scanty supply of water seems also to act as a powerful predisposing

cause. But observation seems also to justify the conclusion, that one who has newly come to a tropical climate, though he be temperate in all things, and placed in equally favourable circumstances with an old resident, will, if exposed to the exciting causes after prolonged exhaustion, be more liable to an attack of sun-stroke than one who has passed several years of his life in the same high temperature. Amongst the many cases of sun-stroke that occurred in the Central Indian Force, the troops composing which were in similar circumstances with respect to rest, fatigue, and food, by far the greater number of seizures occurred amongst those who had recently arrived in that country. I have, moreover, seen European children, born and brought up in India, run and play about exposed to the sun with perfect impunity, whilst men newly arrived in the country were being attacked with sun-stroke. By protracted residence in a warm climate, the system becomes acclimatized, so to speak, or is made tolerant of, or capable of bearing such a degree of heat as would, *cæteris paribus*, undoubtedly be a cause of alarming illness in one not seasoned to such a climate.

Again: Insufficient covering for the head seems to have an undoubted influence in rendering one more liable to an attack of coup-de-soleil. The natives of India most certainly have this conviction, for however inattentive they may be to protecting the rest of their person, they are, as a class, most careful in always having a due amount of covering on the head during solar exposure.

The imperative and harassing duties constantly devolving on the medical officers, the extremely short time that could be allowed to intervene between death and interment, and other causes which need not be mentioned, rendered it utterly impossible to have so many post-mortem examinations as was desirable; but when such took place, it struck me as a remarkable circumstance that the unusual appearances were in degree far from being proportioned to the urgency and rapidity of the symptoms.

The appearances I observed were—an engorged state of the scalp and conjunctiva; a rather turgid condition of the vessels of the pia matter and choroid plexus, and of the veins on the surface of the brain, especially in the neighbourhood of the sinuses; and a slight increase of the ordinary red punctuation of the cerebral substance. Engorgement of the lungs, to an extent to cause a dark purple or even black colour, was the most striking morbid appearance observable in the chest, or indeed in the body. I did not detect any extravasation of blood, and therefore did not see what is properly denominated apoplexy of the lung, which, I believe, has been sometimes seen by other observers; but the engorgement was so great as to bear a striking resemblance to that state. The right side of the heart and its vessels were slightly distended, and the left side of the heart contained a smaller quantity of blood of dark colour. The liver, in general, seemed congested. The other viscera were healthy. I never saw the blood coagulated, and I had no opportunity of examining the spinal cord.

Having endeavoured, in the previous portion of this paper, to describe the smyptoms and post-mortem appearances, the question naturally arises,—What is the mode of death in the various forms of sun-stroke? It seems very evident that, in all but the first and fearfully rapid form, death is by apnœa, or at all events the symptoms of apnœa plainly predominate; and hence the name "heat-asphyxia," given by some to this most alarming disease. The symptoms are distinctly those of that mode of dying in which death commences in the lungs; but by what means the circulation begins to be arrested in the lungs,—or, in other words, the manner in which high temperature operates in causing stagnation of blood in the lungs—whether it be by giving rise to immense engorgement, or by causing imperfect arterialization of the blood,—I do not consider myself qualified to give an opinion.

Everyone knows that non-arterialized blood finds its way with difficulty through the lungs; but it would be interesting to know how the depurating process is suspended to a degree sufficient to induce the commencement of stagnation in the capillaries of the lungs, if that condition of the blood be the cause of failure of circulation through the lungs. On this interesting subject Mr. Martin remarks:—"In all the recorded instances of heat-apoplexy, we have perceptibly presented a great, and, to the European, a most unnatural, elevation of the external temperature, a proportionate rarefaction of the air, and a consequently diminished supply of oxygen at

each inspiration; a resulting deterioration or venalized condition of the blood; a depression of the nervous functions, with augmented animal heat, and an impacted skin. Malaria and other atmospheric impurities, with their consequences, are occasional accessories, with the superaddition also of fatigue and its results. These circumstances, after acting on a system previously injured by improper diet and other intemperance, by disordered or diseased viscera and defective excretion, will go far to account for all the phenomena of this suddenly fatal disease. The condition of the lungs, heart, and brain, immediately resulting from the extremely rarefied air and intense solar heat, appears to be one of extreme venalization of the blood, with acute congestion at first, proceeding rapidly to a passive congestion and greater depression of the nervous and vascular energies, and to consequent narcotism of the lungs, heart, and brain."

It is quite possible that, even in the forms of sun-stroke in which the respiratory apparatus is primarily affected, there may be some degree of cerebral syncope, even from the commencement; but, although it may be an erroneous impression, the study of such cases produced in my mind the belief, held by many, that death is caused by apnœa, or that the symptoms of that form of death predominate.

In the forms of sun-stroke in which the patient, without any premonitory symptom, falls down insensible, makes a few gasping efforts to breathe, and in a few

minutes expires, the symptoms appear very clearly to indicate death beginning in the brain. The sensibility is first destroyed, and, as a necessary consequence, the functions of the lungs are suspended, and circulation of venous blood takes place: circulation of venous blood in this form of dying being the *consequence* of the loss of sensibility; whereas in death by apnœa it is the *cause*. The essential anatomical characters of both modes of death being the same, presenting only differences of degree in the chest and in the head, it is chiefly by the symptoms during life that an opinion can be formed as to whether death was caused by coma or by asphyxia. I am quite aware how speedily sensibility is destroyed in death by apnœa; but many cases of sun-stroke produce a strong conviction in the mind of the medical observer, that sensibility ceases first, and that death begins in the brain.

It would be interesting to know in what way solar heat destroys the action of the brain—whether it be by pressure caused by expansion of its vessels, or by some influence independent of the condition of vessels within the head. In many of the cases which came under my observation, in which death did not take place very speedily, the symptoms merged into those of compression, and the appearances within the head, which I have described, were in character, though not in degree, such as might be expected in death caused by pressure on the brain. I did not see that extreme distension of vessels within the head which some

observers have described, and looking at the brain gave me the impression that some influence apart altogether from distension of vessels must have assisted at least in destroying the functions of that organ. In those cases in which loss of sensibility was the first symptom, and where loss of sensibility was almost immediately followed by death, the state appeared to me to bear a much greater resemblance to concussion than to compression of the brain.

Some of these almost instantly fatal cases brought forcibly to my recollection the experiments of Legallois and Dr. Wilson Philip—experiments made on animals to ascertain the effect produced on the heart and organs of circulation by injuries of the brain. It was found that when violent concussion was produced in the brain, an immediate and great depression, or complete suspension of the action of the heart, was the result; from which it is concluded, that a sudden injury to the brain, such as a violent concussion or shock, suspends the action of the heart, and thus proves fatal; that, in short, death occurs from syncope. The vital powers of the heart seem to be instantly destroyed, for when the chest of the animal is opened immediately after death, it is impossible to excite any contraction; and instead of the veins leading to the right side of the heart, the right side of the heart itself, and the trunk and branches of the pulmonary artery, being found distended, and the left side empty, as in death by coma and by asphyxia, the distinguishing peculiarity is, that there is no difference in the quantity

of blood in the right and left sides of the heart. It is well known that surgeons believe that cases of concussion of the brain occasionaly prove fatal in the same way; and it may be found that some of the almost instantly fatal forms of sun-stroke conduct to death by fatal destruction of the heart's action, caused through the intervention of a sudden impression on the brain. I had not an opportunity of making a post-mortem examination in a case of immediate death from sun-stroke, and cannot therefore say anything from personal observation; but I have understood that scarcely any morbid appearances have been observed in some cases—a condition of parts reconcilable with death by concussion, but not with death by coma or by asphyxia. After the impression was produced in my mind that this may be one of the ways in which sun-stroke produces an extinction of life, I had a great desire to make a careful dissection in a case of almost instant death, but the state of my health soon deprived me of the power of attending to that or to any object of professional interest or duty.

Treatment.—As everyone knows, the tendency observed to this or that mode of dying, is a useful guide in determining the general principle of treatment—the object aimed at being the employment of means best calculated to obviate the mode of death to which there is a manifest approach. The observance of this rule, in cases of sun-stroke, would suggest depletion and means for producing derivative effects, when death is threatened by coma or by apnœa, and the use of stimuli when by

syncope; but the best directed treatment is too seldom followed by favourable results.

My testimony regarding treatment may be given in few words. In many cases of almost instant death by sun-stroke, life was lost before it was possible to institute any mode of treatment; and, in many others, the powers of life were so thoroughly sunk from the moment of seizure that remedies produced no impression on the symptoms. In no case was general bloodletting at all beneficial, but decidedly the reverse. In many instances, I have seen it employed by men of great experience who were well qualified to judge when it was likely to be useful, and the results were always unfavourable; and I have been told by many who had ample means of observation during the summer campaign of 1858, that venesection always seemed to hasten a fatal termination. The result of bloodletting seemed of itself sufficient to show that the vital organs are overpowered by some influence in addition to that of local congestion.

The treatment most generally useful consisted in removing the patient to the shade as speedily as possible —in preserving the body in a proper position—in the energetic employment of cold affusion to the head—in producing as cool an atmosphere as possible around the patient—in the diligent use of friction and heat to the extremities and other parts, so as to cause derivation from the head and chest—in acting sharply on the liver and bowels by mercurial and other purgatives—in frequently administering diffusible stimuli, and in causing

determination to the surface of the chest by applications of mustard or of turpentine. Along with these remedies, local depletion from the head seemed sometimes to be beneficial. When the patient became comatose, blisters to the back of the neck, and stimulating cataplasms to the feet or legs, were tried; but, in too many instances, they were of no avail.

Another measure, to which Dr. Simpson, of her Majesty's 71st Regiment, attached importance, was to engage the patient's attention by keeping him answering questions put to him in a loud tone of voice; to rouse him up by continually talking to him, and by rubbing his limbs; and not to leave him to himself till the remedies should have fair time for their operation. This expedient seemed, in some cases, to assist in warding off the insensibility, if not in some cases to prevent its accession.

Under the use of the above-mentioned treatment, modified according to circumstances, many patients recovered; but, in too many instances, the result was fatal to those who were attacked with this singular disease.

Not having had an opportunity of consulting the works of the authorities on this affection, the above observations can be of no value except as being a faithful account of what came under my own observation in numerous cases of sun-stroke which occurred during Sir Hugh Rose's summer campaign of 1858, in Central India.

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