

of the foreign body is sucked into the catheter, and in this way may be withdrawn.

One of my recent cases was a curious one, and was seen in consultation with Dr. Robert Roberts. A middle-aged healthy man, a month previously, passed a piece of bacon rind about two inches in length up his urethra, which disappeared. Not feeling satisfied with this strange exploit, he introduced, a week afterwards, up the same canal, a stiff pig's bristle about five inches in length, which also disappeared. Ten days before I saw him he felt a severe pricking sensation, and at once confessed his indiscretions to his medical adviser. When we saw him in consultation I passed a soft instrument down his urethra, and distinctly felt something in the prostatic urethra, which I pushed backwards into the bladder. As I felt so doubtful as to the man's statement, I employed a small lithotrite, with which I felt something I could not hold. I then passed a large-eyed evacuating catheter into the bladder, and attached a powerful rubber syringe to it, such as I use for the removal of stone fragments after lithotomy. After a few movements of the syringe I felt that I had engaged something in the eye of the catheter, and on withdrawing the latter, the bristle, beautifully coated with phosphates, came with it. Of the bacon rind I neither felt nor heard anything more. These manoeuvres were quite easily carried out on my consulting-room sofa without an anaesthetic. Some weeks previously I had removed a piece of gum-elastic bougie (No. 6), three inches in length, in the same way. To commence with, I felt, as the water current was being ejected, the bougie struck against the eye of the catheter with its long axis, and was therefore not caught. I distended the bladder with another syringeful of water (four ounces), when at once the end of the bougie became impacted in the eye of the evacuating catheter, and was withdrawn like the bristle. The additional amount of water permitted the bougie to rotate in the bladder. Still more recently, by the same process, I dislodged a renal calculus which I believe was impacted in the orifice of one of the ureters, where for some weeks it had caused much irritation.

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## HEATSTROKE.<sup>1</sup>

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A GREAT deal has been written on the subject of heatstroke; still it has occurred to me that a brief account of my experience in India in this respect might not be altogether void of interest.

If we exclude heat exhaustion, which is simply the result of exertion and fatigue in hot weather, where the sufferer falls down with a freely perspiring and cold skin, and where the phenomena of sun or heat stroke, which I am about to describe, do not ensue; then, I think, the following division will embrace the various forms of the disease: 1st, Ardent Fever; 2nd, Heat Apoplexy; 3rd, Sunstroke. Such a classification seems to me more fully in accordance with the deviation from the normal temperature of the blood; the effect varying not only in relation to the height of temperature reached, but also in relation to the rapidity with which it is reached. No description of any given disease, or its varieties, can possess the clearness of outline of a photograph: the grouping of the varieties must be more or less arbitrary, but so long as it is conformable to nature and recognisable in practical life, that is all that is required for the purposes of useful classification.

By ardent fever I mean a non-specific continued form of fever, resulting from exposure to heat, and of comparatively short duration. Heat apoplexy is a heat fever attended with high temperature, contracted pupils, cyanosis, loss of consciousness, and a marked tendency to death by asphyxia. It more commonly results from the indirect effects of solar heat, or radiated heat, and usually occurs at night, in dwellings or in crowded tents. Sunstroke is a form of heat fever with a very high temperature, contracted pupils, and rapid loss of consciousness, and it is frequently attended with convulsions indicative of perverted action and exhaustion of the nerve centres. Both here and in heat

apoplexy there is marked cardiac debility and embarrassment, probably largely due to a paresis of the sympathetic heart centres. In brief, it will be seen that all three of the foregoing are pathologically allied; they are, as it were, so many beads of different sizes and colours united on one and the same thread.

In ardent fever we have commonly portal congestion and increased metabolism of the liver, *plus* the effect of heat on the nervous system. In heat apoplexy we have a poisoned state of the blood resulting from vitiated atmosphere, arrested secretions, with possibly the addition of alcohol, forming in combination the dominating factor; and heat, not direct solar but radiated heat, as the subordinate but determining factor. In sunstroke, we have the direct and dominating factor of solar heat, acting on the cortices and meninges of the brain and spinal cord, *plus*, it may be, a toxæmia as a subordinate predisponent factor.

I would here refer for a moment to the two main sources of animal heat—viz., the muscles, which are the chief source; and the glandular organs, which stand next in order of importance. The muscles of an adult man form nearly half of the whole body weight, and contain about one quarter of his blood. From this, says Foster, "it may be inferred that a large part of the metabolism of the body is carried on in the muscles." Whenever a muscle contracts, heat is given out; and wherever metabolism is, there heat is generated. It is not difficult, therefore, to understand what a seriously predisposing cause to this disease over-exertion is, over and above the nervous exhaustion resulting from fatigue. Of the glandular organs the liver is by far the most important. It contains about a quarter of the whole blood of the body, and we know what extensive metabolism takes place in that organ. It is consequently clear that congestion of the portal system, induced by intemperance in food and drink, is also a powerful predisponent.

Then we have the regulation of the body heat. Of these, the three principal regulators are the skin, the lungs, and nervous systems. The skin is the most powerful; it regulates by means of conduction, radiation, and evaporation of perspiration from its surface. It is obvious that conduction and radiation can reduce the heat of the body but very feebly when the surrounding media are as hot as, or hotter than, the body itself; and when the air is moist and still, as well as hot, evaporation from the surface is reduced to a minimum. In the severe forms of the disease, more particularly in heat apoplexy, we have stertor, and so engorged a condition of the lungs that, on section post mortem, the blood drips freely from the cut surfaces. Hence we may assume that the heat-regulating sources of these organs are seriously impaired. Foster, in his work on Physiology, shows how the vaso-motor mechanism influences the regulation of the body heat. He tells us that a vaso-motor action, which by constricting the cutaneous vascular areas, or by dilating the splanchnic vascular areas, causes a smaller blood flow through the skin and a larger one through the abdominal viscera, will tend to increase the heat of the body. But this observer, while admitting that the influence of the nervous mechanism in animal heat, not only in maintaining the normal temperature, but also in affecting the variations of temperature in disease, can hardly be exaggerated, adds that much requires to be learnt before its exact value can be confidently spoken of. I think, however, I have shown how the sources of heat are increased and the outlets blocked. From this we must have rising body temperature with heatstroke as the result, unless the supply be diminished or the outlets opened.

And now I come to the treatment, and it is chiefly on account of a point that I wish to emphasise in this part of my subject that I have ventured to bring this subject forward.

Prophylactic measures, though perhaps obvious, cannot be passed by unnoticed. People who live, and soldiers who serve, in hot climates cannot get rid of heat; but they can do much to modify it by living in well-ventilated rooms, with a suitable proportion of cubic space and superficial area for each occupant. They can make the still air move by means of fans or punkahs. They can be temperate both in eating and in drinking; and more particularly they can abstain from alcohol altogether, or take it only sparingly and well diluted with water. Alcohol has a powerful deleterious influence, because (1) it increases portal congestion, and (2) it has, whilst in the circulation, a great attraction for water. They can clothe in garments that are light

<sup>1</sup> Read in the Military and Naval Section of the International Medical Congress, held at Washington.

both in colour and in weight, and loose enough to admit of the freest respiratory movement. Dr. Arnold Hiller, of the German army, in a lecture he very recently delivered to the officers of his corps, laid great stress on the importance of this point; indeed, he regards great heat alone as a subordinate factor to the detention and accumulation of heat brought about by heavy clothing. He also relates some experiments showing the great value of perspiration and its increased effects when assisted by wind. When troops are marching in hot weather, the march should be made at night, or sufficiently early to be completed by 7 A.M. Urgent military necessity is the only good reason for neglecting this precaution. The ranks should be as open as possible, and care should be taken that the men's water bottles are filled before starting. Cold tea flavoured with lime-juice is an excellent beverage for the purpose. Tea and coffee are excellent respiratory excitants, and free from the evil influences of alcohol. The marches should not be too long, and food should be taken before starting and at halting places as safeguards against fatigue.

In cases of simple ardent fever, the initial step in the treatment is to relieve the congested portal system by an aperient, and none is more suitable than a dose of calomel (from two to four grains), followed by such a saline as sulphate of magnesia. Cold sponging of the body or the wet pack lowers the temperature, refreshes the patient, and frequently induces sleep. Quinine, in doses of two or three grains, is indicated, and in my experience has proved efficacious. The bromides of potassium or ammonium are useful. In the Punjab and North-West Provinces of India I have often seen over 20 per cent. of the strength of recently arrived regiments in hospital in the months of April, May, and June from this cause. Here I may incidentally remark that at Peshawur we have two forms of fever differentiated from each other by the seasons of their accession or prevalence. In April and May it is an ardent fever, short in duration and continuous in type, over which quinine exerts no specific influence; in brief, it is the ardent fever of which I am speaking. But in October and November we have a fever of an altogether different type—viz., a malarial fever varying in degree from a simple ague to its most pernicious form, resembling cholera, in which quinine, arsenic, and change of air are alone of any avail.

In the graver forms of heatstroke much more active measures are urgently called for. My practice has been to strip the patient instantly; to lay him on an inclined plane by raising the head of his bed from ten to fifteen inches from the ground; to place him, if possible, in a current of air, and, failing that, to make attendants circulate the air around him by fans or hand punkahs. He should be doused freely, but not suddenly, by pouring cold water in good volume over the head, chest, and abdomen; and the bowels should be quickly cleared by an enema. None of these measures should be omitted. But what I am especially anxious to bring to your notice is the beneficial results obtained by the hypodermic use of quinine in these cases. As far as I am able to ascertain, this is not the general practice of English physicians, whatever it may be with those of this country. Sir Joseph Fayrer, in his able article in Quain's Dictionary of Medicine, incidentally remarks that "this method of treatment has been supposed to give good results by its influence on the vaso-motor nerves and retarding tissue change." And Dr. Roberts Bartholow, in his work on the Practice of Medicine, says: "The subcutaneous use of quinine may also be practised to reduce heat." I venture to think, however, that in quinine so employed we have a remedy of much efficacy in such cases—at least it has proved so in my experience in many instances; and I believe its more general use would be attended by a much lower mortality than that usually recorded in this disease. I have seen patients in a state of coma from heatstroke so far recover in from ten to fifteen minutes after the subcutaneous injection of quinine as to be able to protrude the tongue when desired to do so, and to show by signs or speech that they understood a question put to them. I have a clear recollection of having one morning, when in cholera camp at Mian Mir, without a tree to shelter our tents from the fierce heat of a Punjab sun in July, by the subcutaneous use of quinine, with a fatal result only in one instance, treated fourteen cases of heatstroke. All these cases were of such severity that the patients were insensible. The dose I use for injection is from two to four grains, and this may be repeated at such intervals as may be indicated by the condition of the patient. I have administered a second

dose in half an hour after the first, and a third in two, three, or four hours after the second. When we reflect how narrow is the line between life and death in these cases of hyperpyrexia, and remember that with a body heat of even 107° F. there is still time to save life, but that at 111.2° death ensues, it is everything to possess an agent which will control the degree of temperature in a few minutes. I claim for the subcutaneous use of quinine in the treatment of heat-stroke this property.

There are certain precautions that must be observed in this method of administering quinine. 1. The solution must be perfectly clear; it must be filtered if necessary. 2. The salt used must be one that is perfectly soluble in distilled water without the addition of any acid. Such a salt is the quininæ hydrobromas acidæ. This is a very soluble form; it dissolves 1-6 of water, it is richer in the alkaloid than the sulphate, and it is quite unirritating. Both of these precautions are essential in the hypodermic use of quinine, because some local irritation may follow the injection. I have heard of two cases of tetanus that were alleged to have been caused by the operation. In my own practice no such misadventure ever occurred, and I have used quinine subcutaneously many hundreds of times; for before I became acquainted with the advantages to be gained by treating heatstroke after this method, I had frequent recourse to it in the treatment of obstinate malarial fevers, when quartered in such malarial districts as the Valley of Peshawur, in the north of the Punjab. The addition of morphia to the quinine solution has been proposed as a safeguard, but I never found its use necessary, and of it I have no experience. How quinine acts in the way I have described I cannot tell, but that it has a special effect on the nervous system, particularly the cardiac ganglia and the vaso-motor nerves, seems highly probable, from the rapidity with which the effect follows the injection. I am aware that some eminent authorities—Professor Binz for example—hold that quinine exercises some specific influence on the blood-corpuscles; still, I believe the explanation is rather to be found in its effect on the nervous system.

Since the date of my service in India, several new antipyretics have been introduced; and I understand that antipyrin, for example, has been used hypodermically in America in the treatment of heatstroke. I know that in the British army both antipyrin and antifebrin have been employed in the treatment of ardent fever with very beneficial results, and their use in sunstroke will consequently be indicated.

## PENETRATING WOUND OF ABDOMEN WITH PROTRUSION OF INTESTINE; ABSENCE OF SHOCK.

By J. W. GRANGE, M.B., C.M.

A. N—, aged twenty, a ploughman in robust health, while walking through a field, was attacked by a bull, knocked down, and gored in the abdomen. The bull's attention was then directed to a couple of dogs, the only help at hand, and the man escaped over a hedge. He says that when he rose up his trousers were torn and bloody, and he saw his bowels hanging out, forming a large mass, which he caught in his hands. Supporting them in this way, he walked home, a distance of a quarter of a mile, and up-hill, before he could get any assistance.

As the man lived far out in the country, it was two hours after the injury had been inflicted before I saw him. He was then lying in bed, and did not present any symptom of shock. His face was of a good colour, his pulse strong and steady, and there was nothing in his appearance to indicate that he had met with such a serious injury. On opening his trousers a large mass of intestine lay over the right side of the abdomen, in volume about as much as one could carry in two hands, consisting of about four feet of small intestine and mesentery. The bowel was dull and congested from constriction, but otherwise uninjured. The wound, completely hidden by the overlying bowel, was situated in the right iliac region. It was rectangular in shape, and about four inches long. The opening in the peritoneum, however, would barely admit one finger. After cleaning the bowel from sand and dirt, reduction was tried, but unsuccessfully, as any attempts to replace the bowel sent it into