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ON
**SHOCK AFTER SURGICAL OPERATIONS
 AND INJURIES.***

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TREATMENT.

THE treatment of shock varies with the degree of its intensity and the nature of the prior injury. It should, in all cases and at all times, be of a kind to assist nature as far as we know how. In the slighter cases of shock, a negative policy is the wisest—giving the natural powers of repair all the conditions of ease and of mental and bodily rest, which conditions should be continued for some time after the indications of shock have passed away. In cases of severe shock, in addition to the measures adopted for slighter cases, it will probably be desirable to administer stimulants in moderate amount, and apply external warmth. Sinking is often, especially after operations, greatly relieved by nourishment, as well as by stimulants. It is often recommended to give stimulant sparingly, because of its augmentation of the ensuing reaction. This caution may be, and often is, carried too far. Stimulants only to a limited degree influence reaction; and, secondly, the smarter the reaction, the more favourable (as Mr. Paget has well shown) the result. In direct injuries to the head, stimulants should undoubtedly be given with greater than usual caution. A little opium added to the stimulant has a most favourable influence in most cases of shock. In cases of extremely severe shock, it is often difficult to succeed in giving brandy or opium with effect. My experience of cases of great exhaustion has impressed me with this practical conclusion: that, where brandy and opium have their natural effect, the case, so far as shock is concerned, promises well. In such cases, large quantities only increase the calmness and regularity of the nervous and circulatory functions. In a case of ovariectomy recently under my care, for many days exhaustion and restlessness were relieved by nothing but brandy in large quantities, and a teaspoonful of laudanum three and sometimes four times during the twenty-four hours. Any attempt to diminish these quantities was for several days attended with great danger. Ultimately the case did well, and both remedies were abandoned with ease. Where the stomach rejects brandy and opium, it is desirable to introduce them, with beef-tea or other nutritive fluid, into the rectum. I believe collapse to be a condition completely under control, when the subject of it can be made tipsy with brandy or sleepy with opium. In the gravest cases of shock, these reme-

dies appear to have no influence whatever. External heat is always of the greatest service (in cases of shock from cold, heat should be very gradually applied, friction and cold being the earliest remedies), and is conveniently supplied by hot-water bottles, not to the feet only, but to many parts of the body.

It is in the severest cases of shock—those, namely, in which shock itself threatens a fatal result—that the greatest promptitude and care are required in the treatment. I have no hesitation in saying, on grounds of experience, of philosophical deduction, and of physiological experiment, that by far the most important remedy is immediate and extreme external heat. Death in such cases occurs from cold, and there is no time to wait; indeed, it may be impossible to secure the generation of internal heat by means of brandy. External heat, where it is practicable, as in hospitals, where the majority of these cases are treated, is best supplied by the hot-air bath. Chossat's experiments on pigeons are pertinent to this question. In pigeons that were on the point of death from starvation (in which cases death is also from cold), the muscular and nervous functions being completely in abeyance—a condition very little removed from death itself being present—manifestations of comparatively active muscular power were obtained by placing the pigeons in a heated atmosphere. In addition to the external heat, brandy, opium, beef-tea, and other nutritious fluids, will be desirable, either by the stomach or by the rectum. If any coma be present, opium should not be given; neither should it be given in slight shock; nor in direct injuries to the head, except strongly indicated by restlessness, sleeplessness, and delirium.

Where there is reason to fear that respiration is about to cease, and the injury is not of a necessarily fatal character, artificial respiration may be desirable, although, in most cases, external heat (which in these cases is possibly interchangeable with nerve-force) will answer better. In cases where death threatens from loss of blood, transfusion offers a chance of recovery, which, when it is practicable, should not be neglected. In all cases of shock, and in every operation where it is possible, the recumbent posture should be preferred to any other, and should be maintained until all fear of failure of the heart's action has passed away.

Can anything be done when the circulation has actually ceased? There is now no doubt that it is quite possible for the heart to resume its action after complete cessation of all movement. How to secure a return of action is a question of almost oppressive responsibility on the part of the surgeon. Mr. Savory suggests the following treatment, which I give in his own words (*Holmes's System of Surgery*, vol. i, p. 716).

"If an animal be killed by shock, such as sudden destruction of the spinal cord and brain, and the chest be opened within a minute or two of the operation, the heart will be found motionless, or with the slightest flickering movement, most apparent in the auricles, and distended with blood. The veins, too, are in the same engorged condition. If now the right auricle or ventricle be punctured, blood will pour out; and this will be instantly followed by a striking increase in the heart's action, which will continue to improve for some time. Or if the dis-

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tended jugular vein be opened in the neck, the heart will resume its action as soon as relieved. While the heart remains paralysed by distention, it cannot recover.

"In such a case, therefore, the superficial veins of the neck should be examined; and if distended, the external jugular should be opened. This treatment is sanctioned by both reason and experiment. Nothing else seems to offer any prospect of success. Electricity has been recommended; but, even if it could be obtained at the precious moment when required, the principle of its application is, to say the least, a very doubtful one."

I have not observed in the human being the turgid condition of the jugular veins referred to; and *post mortem* examination in cases of fatal shock reveals only a moderate quantity of blood in the heart. Where the heart has actually ceased to beat, I believe that experiments on animals that have certainly been resuscitated in this way indicate the possibility of restoring the cardiac action by means of a rapid puncture of the heart with a long sharp needle.

The Treatment of Reaction, like that of shock, is rather of a negative than a positive character. To watch and assist nature is our chief duty. Some diminution of diet, some purgation, and plentiful supply of bland fluids to satisfy thirst, may be necessary. Under ordinary circumstances, so far as shock and reaction only are concerned, it can rarely, if ever, be necessary to bleed. In wounds of the thorax, and on grounds other than those of shock and reaction, it is a controverted point, whether bleeding shall be resorted to or not.

THE PREVENTION OF SHOCK.

It is the duty of the surgeon, as far as he possibly can, to prevent shock. It is probable that, in some degree at least, and certainly so far as the psychical causes of shock operate, chloroform answers this purpose in surgical operations. As regards the administration of chloroform in operations during the existence of shock, considerable difference of opinion prevails. Thus an excellent observer, Mr. Lister, advises the use of chloroform in such cases, and remarks that the circulation becomes stronger under the influence of chloroform. A sphygmographic trace, taken under chloroform in one of the cited cases, suggests this view. Mr. Savory, also an excellent surgeon, considers chloroform inadmissible, and observes that it is the less necessary because the subjects of severe shock feel little pain from the subsequent operation. My practice has been to administer a little chloroform, and less suffices in these than in ordinary cases; and I think that the practice has decided advantages.

On so important a question as the effect of chloroform in warding off shock, I determined to ascertain what information might be afforded by experiment. At my request, the two following experiments were performed by Dr. Norris. The first experiment was designed to show the effects of a given injury under the influence of chloroform, and the second to show the effects of a similar injury without an anæsthetic. I give them in the words of Dr. Norris, written (as in the previous experiments I have brought forward) at the time.

"Etherised a frog. Observed that the heart still continued to beat forcibly, and to raise sensibly the parietes of the chest. Placed the webs under the

microscope, and found the circulation proceeding vigorously throughout the capillaries. The head was now crushed by a blow from a hammer. Examined the webs within a few seconds, and found that the circulation had been arrested; a little sluggish movement in some of the supplying arteries. No apparent movement of blood in the capillaries. At the moment the head was crushed, not the slightest motion, either of a convulsive or tremulous character, occurred in the limbs. This indicates that the anæsthesia of the nervous system was complete. Twenty-four minutes after the operation, slow movements of the blood-corpuscles were still observable in the arteries. In one of the arteries I observed a to-and-fro motion of certain groups of corpuscles. These movements I attributed to irregular contractions of the vascular coats; but, to make sure that the heart had no part in their production, I removed the skin from the parietes of the chest; but, on careful and prolonged examination, could not detect the slightest cardiac impulse. I then completely exposed the heart; and, although quite quiet at first, it soon commenced (as usual on exposure) to beat at irregular intervals, and continued to do so for about an hour. It is clear, therefore, that the action of the heart was arrested by the injury suddenly done to the nervous system."

In the following experiment, no ether or chloroform was used.

"A vigorous frog was taken, and the webs examined microscopically. The circulation was proceeding in a normal manner. The head was now, at 9.38 A.M., completely crushed with a hammer. In a second or two, the webs were again examined, and the arteries and capillaries were already exsanguine. A little movement of corpuscles in the veins was still observable. Two minutes having elapsed since the injury, scarcely a perceptible movement could be detected in the webs; the veins have also become pale and indistinct. On the whole, I am struck with the general exsanguine appearance of the webs, which seems more marked than in the cases in which chloroform was used. No reflex movements could be induced by irritating the periphery. 10.30. Slight movements occasionally occur in the veins. No return of reflex power."

The difference in the result of the two experiments just cited is not very great or very definite; but what difference there is, is distinctly in favour of the beneficial influence of chloroform. If these experiments proved merely that chloroform was not absolutely injurious, their importance would not be slight; and to the advantage, whatever its importance may be, which the experiments enable us to infer, we have to add the almost incalculable advantage, which chloroform affords, of protection from the operation of psychical causes of shock in surgical operations. But I believe that chloroform is not only not injurious: it is positively advantageous in diminishing shock, not merely in preventing mental influences, but also in maintaining the vital powers. The patient who has been operated upon under the influence of chloroform is less the subject of shock than a similar patient, under similar circumstances, upon whom an operation has been performed without the aid of chloroform. The thermometer shows that chloroform gives rise to not the slightest diminution of temperature—a diminution we should certainly obtain from the operation of any depressing agent; while the sphygmograph indicates that, under its influence, the heart acts with increased power.