

Dr. Charles M. Kelsey<sup>6</sup> epitomizes this entire subject in the following advice given to students attending his clinic:

If you wish to radically cure your patients with the least possible pain, loss of time, confinement to the house, and risk of accident, use the clamp and cautery.

If you wish to accomplish the same results with no more risk, but with more pain, more local and general disturbances, use the ligature.

If you wish to take an hour to do what can as well be done in a few minutes, and gain nothing more by it in the results, use Whitehead's operation.

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## PRE-OPERATIVE AND POST-OPERATIVE TREATMENT OF SURGICAL CASES.\*

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The question has often occurred to me that some surgeons at least view all therapeutic measures as more or less empirical or useless, and lay too much stress on what can be accomplished by operative procedure alone.

Specialists in any given line are prone to look on any given subject from their point of view; in fact, we are of the opinion that many surgical cases before operation are not treated as they should be, so as to prepare them for the great ordeal and shock incident to a major operation, and as a result of this lack of treatment or proper preparation before operation, they are likely to have to be overtreated after or during the operation.

As a matter of course, in emergency surgery, we often have no time for general treatment, but many other surgical cases are materially benefited by proper attention to their general health, the careful flushing out of the bowels, kidneys and liver; the regulation of the heart as to its beat and tone; respiration as to its depth and regularity, and the proper building up of the nervous system and the blood count by suitable medication.

We have seen much good result from dieting, tonic capsules of iron, quinia, strychnia and cascara or liquid preparation of iron and manganese preceding some operation, especially in anemic malarial subjects, which, without the previous building up, would hardly have been able to undergo the shock of any serious operative interference. In other cases, where the long drain of chronic diseased conditions have undermined the nervous and circulatory systems, much good may be accomplished by giving digitalis, strychnia and iron, till the heart is toned down by digitalis, and the nervous system braced up by the action of the strychnia and the blood count built up by the iron. As a matter of course, no imperative operation should be made to wait for the result of such medication, but the idea that we mean to convey is that when any such case may have to wait from any cause, the period of such waiting should be utilized in the general up-building of the patient's vitality.

Many times surgeons are called on to operate on patients who have led rather fast lives; who have not only burned the candle at both ends, but have overtaxed the stomach, overworked the liver, and kept the kidneys choked with excrementitious material which should have been flushed out. All such cases are very much ben-

efited by thorough purgation with calomel and soda, or any other simple cathartic, if mercury is contraindicated. The thorough emptying of the bowels and stimulation of the secretions does away with half of the vomiting, which we have seen in cases which have not been properly purged before the operation.

Regulation of diet for several days previous to an operation so that no indigestible material is left in the alimentary tract, is another important detail to look after. The greater the quantity of water imbibed and the better the kidneys and bowels are flushed out, the better the chance for the patient to stand the operation.

In emergency operations one-fourth grain of morphia, enemata of hot milk, coffee and whiskey all tend to ward off shock. In any serious operation, Professor Smith recommends the previous administration of whiskey almost to the point of intoxication.

This plan is more suitable for subjects accustomed to drink than to follow as a general rule. The application of bandages formerly recommended to store up blood in the extremities is not practiced to any extent at present, but the saving of all the blood possible by the Esmarch bandages and the elevation of the limbs to be amputated, is doubly important in all very young or old subjects.

Mikulicz found that blood regeneration in an operation in which 1 per cent. of blood was lost, was made up in from two to five days; that 3 per cent. was made up in from five to fourteen days, and 4 per cent. was regenerated within thirty days. Usually we expect the blood regeneration to be complete within fourteen days. Mikulicz never operates on a patient whose hemoglobin is under 30 per cent. In all anemic and accident cases, where a great amount of blood has been lost, this 30 per cent. hemoglobin test is a good rule to follow, waiting, if possible, to build up the hemoglobin to the required 30 per cent. standard before operation.

We often see mucous patches and syphilitic ulceration of mouth, tongue and throat that in some degree resemble epitheliomatous growths so closely that it is hard to differentiate between the two. Recently such a case came under my observation, under the treatment of a throat specialist, who informed the patient that he had cancer of the tongue and tonsils, and must undergo a complete removal of those organs with all the deformity and consequent inconvenience incident thereto. The pathologist had examined the tumor and reported it an epitheliomatous growth. It certainly looked suspicious, and had a cancerous history, but behind all of this was also a vague syphilitic history. The patient refused to be operated on without seeing another specialist, who, on consultation, decided to try the test of free administration of iodid of potash and mercury, so the patient was given 20, 30 and 40-grain doses of iodid of potassa three times daily, well diluted, after meals, combined with protoiodid mercury pills. The effect of the treatment began to show after the first week, in diminishing the size of the ulcer and causing it to become paler and less hemorrhagic. Two weeks noted more marked improvement, and within a month the tumor had disappeared and the ulcer healed. In all cases of ulceration about the throat and tongue in syphilitic suspects, give the test treatment with iodid of potash and mercury, before any operative procedure is suggested. The time required for the test is only one month. The power of iodid of potassa and mercury in effecting such cures is almost miraculous. This recommendation, if followed, will clear up many suspicious diagnoses.

So much for pre-operative treatment. Let us now

6. The Treatment of Hemorrhoids, New York Med. Jour., June 16, 1894.

turn our attention to the patient who, from loss of blood, shock and anesthesia, or any other cause is *in extremis*, as the antiseptic details of modern surgery tend to prolong operations and to the production of shock.

We can hardly speak of post-operative treatment without going into the definition and details of shock. The demand for treatment is usually brought about by the loss of blood, shock or fat embolism. The essential condition of each is anemia of the brain, fast, weak-acting heart, inhibition of nerve force, with reflex paralysis, exhaustion of the active force of the medulla oblongata and spinal cord, accompanied by subnormal temperature. The weakness of the heart's action, combined with the paralysis of the vascular tone disturbing the circulatory balance, the abdominal veins become overfilled by gravitation, and the right side of the heart is greatly distended. These conditions necessarily lessen the amount of blood in the arteries. If this arterial pressure is very much lessened, anemia both of the lungs and brains soon follows. A slight degree of shock may follow almost any traumatism or great loss of blood, but it is more severe in contusions and gunshot wounds of the viscera, crushing injuries of the extremities and testicles, and to burns and scalds extending to half or more of the body surface. We can differentiate hemorrhage from shock to some extent by the blood count, which should not fall below 3,500,000. The nature of the injury will also assist in making the diagnosis. In shock, circulation is vitally depressed. It is supposed in the case of crushed limbs to be brought about by nervous exhaustion, caused by continuous and severe irritation of peripheral, sensory and sympathetic nerves.

Rogers, in experimenting on frogs that he had shocked by electricity, observed that the spinal cord and muscles were not sensitive to drugs or stimuli, as, for example, strychnin failed in its effect on the spinal cord. The tissues seemed to be unable to react, or the strychnin seemed to fail of passage from the blood to the tissues. These experiments in part explain some of the observations of Crile, namely, that powerful, stimulating remedies fail in their mission to relieve exaggerated shock, and when given in too large doses may result in an absolute toxic effect on the patient. The following observations of Crile, while some of them are contrary to our clinical experience, are worthy of note in this connection. Crile contends that nitroglycerin, strychnia, alcohol and all other stimulants of vasomotor centers tend, like traumatism, to the production of shock.

Where the operative field invades a part rich in blood vessels and hemorrhage is hard to control, the amount of blood lost is often great in quantity, even though we use all the precautions possible by immediately clamping or tying every vessel that spurts. It is after such operations and in collapsed conditions that intravenous infusion and hypodermoclysis accomplish such good results by raising blood pressure, stimulating the endocardium, thus exciting the heart to action, filling up the empty blood vessels and stimulating the anemic brain. The amount of saline infusion should be governed by the amount of blood lost and its effect on the pulse. It is better to stop at two pints, if the pulse is restored, taking the chances of having to repeat it again if required, rather than to bring about pulmonary edema, for Crile found when the infusion amounted to 320 c.c. kilo., the fluid accumulated in the splanchnic area and embarrassed respiration by mechanical fixation of the

diaphragm and ribs. We have seen pulmonary edema increased and damage done by using intravenous infusion in a case of albuminuria with suppression of urine.

Crile had the most lasting effect when to his saline infusion he added 1/50,000 adrenalin. He resuscitated animals that had been dead for ten (?) minutes by these infusions, combined with rhythmic pressure on the pericardium and artificial respiration.

We may have delayed shocks after an operation is completed, hence the importance of keeping the patient quiet and comfortable, with the foot of the bed raised, if much blood has been lost. During collapse the best clinical results are obtained medicinally by the hypodermic administration of 1/30 grain of strychnia, combined with 1/60 grain digitalin. If we could foretell, in any given operation, that shock was liable to occur, it would be well to reinforce our patient by giving him either a stiff toddy, 1/4 grain of morphia, 2 grains citrate caffeine, or a hot cup of coffee an hour or two before operating.

When from any cause serious or profound shock is produced, only the necessary interference to check the hemorrhage and stop the pain should be attempted, and even that should be done without the aid of anesthesia; morphia, under such circumstances, acting better than ether or chloroform. The exception to this rule is when the shock seems to be aggravated by a crushed painful limb; it is better to amputate under the influence of morphin and ether, thus removing the cause of the shock. The blood should be forced into the more vital parts by raising the limbs, if not injured, rather than by bandaging the extremities. Dry heat and mustard with friction to be applied freely, flannel cloths wrung out of hot water and sprinkled with turpentine should be applied over the precordial region. In some of these cases the most powerful stimulation fails to act. When, from either shock or anesthetic, respiration or circulation stops from anemia of the medulla oblongata, the head-down, inverted position, combined with artificial respiration with rhythmic pressure on the heart, affords the best chance for relief. Artificial respiration, with chest compression, not only brings in new oxygen, but expels whatever chloroform or ether vapor remains with the residual air. It is then that artificial respiration, lowering the head, infusion and faradization come to our relief. With one pole of the battery over the phrenic nerve and the other over the diaphragm, we can tide over some cases that otherwise might prove fatal. We should not try to force hot, stimulating drinks down a patient who can not swallow, as fatal strangulation may result, but if deglutition is not impaired, 10-minim doses of the tincture of digitalis dropped on the back of the tongue slows down the fast, weak-acting heart, but its culminative effect should be remembered, and it should not be repeated too often, as cardiac failure might follow overstimulation.

Many times the patient being operated on is not kept warm enough. Moisture from wet towels and dressings are left to be evaporated by the latent heat of the body. During the winter months, in cold climates, at least, the operating room should be kept at 72 F., and with some cases it is best to have the operating table heated by coils of hot water circulating underneath the table. Shock is superinduced by draughts, and at no time during or after an operation should a patient be uncovered except the actual part to be operated on. The patient should be kept warm when going from the operating room to his private bed, which should be well heated

before he is moved into it. In all our treatment, to bring about reaction, we should stop short of producing overaction and its sequence, which is secondary hemorrhage. Whenever it becomes necessary to operate on one who is very old it is important to reinforce their vital powers by a tonic course of strychnia a week or more before the operation, as it does much more good in this way than when given on the operating table. Confinement in bed is very damaging to these old people; they ought to be propped up in bed, or removed to a chair just as soon as it is practicable. It is important that operations on old persons be as bloodless as possible.

In these conditions of post-operative shock, do we not, under some circumstances, overtreating the case? Many times, with the heart scarcely beating for the lack of blood stimulation, with respiration sighing and shallow, with patient bathed in cold perspiration, we have seen one hypodermic injection after another containing stimulating poisons given in such quick succession that we may well pause to ask ourselves the question, are we not confusing and overpowering a circulation and respiration almost extinct by the rapid successive administration of such strong drugs as nitroglycerin, strychnia, digitalin, atropin and morphin into a subject already overpowered by a general anesthetic, loss of blood, shock and collapse? Under the excitement of such conditions, proper time very often does not elapse from one dose to another to see what the effect will be. Again, drugs having diametrically opposite effects are often used and stored up in the system. We are not claiming this to be a common practice in well-regulated operating rooms, but I am sure that many of us have witnessed cases in which the postoperative treatment was overdone.

It has always been my idea that, if surgeons would spend more time in getting the patient in proper condition to stand the operation, in having everything in readiness, in having assistants trained in what they are expected to do, and also if the least possible time were consumed in performing the operation, and if all lectures and explanations were suspended until the operation is finished, much less of the first necessary poison, viz., the anesthetic, would be required, and we would have fewer cases in *extremis* to deal with after operations.

## THE MECHANISM OF STREPTOCOCCUS INFECTION.\*

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### INTRODUCTION.

Although a great deal of work has been done on the mechanism of streptococcus infection, both with normal and with immunized animals, many points are still left entirely in the dark. In the experiments described in this paper, an attempt is made to throw additional light on some of these points, but on account of the many inherent difficulties, the results which I have achieved by no means exhaust the problem.

Shortly after the publication of his classical paper on phagocytosis in daphnia, Metchnikoff<sup>1</sup> made a study

of phagocytosis of streptococci in the human body, in cases of erysipelas. He concluded from his observations that streptococci gain entrance through abrasions of the skin, multiply and set up an inflammation. At the same time there is a gathering of microcytes about the streptococci, and these soon take up the latter and destroy them. Macrocytes also are found in considerable numbers, but they do not take up the streptococci, but have, nevertheless, a phagocytic action, in that they take up and remove dead and disabled microcytes.

In 1895 Denys and Leclef<sup>2</sup> studied the mechanism of immunity in rabbits which had been repeatedly injected with small but gradually increased doses of virulent streptococci. Their conclusions may be briefly stated as follows: Immune rabbit serum is not as good a culture medium for streptococci as normal serum, but it does not possess any marked streptococcidal powers. The cell-free fluid from a leucocytic exudate retards multiplication of virulent streptococci and sometimes kills them. Normal leucocytes in normal serum, and leucocytes from an immune rabbit suspended in normal serum, do not greatly retard multiplication of virulent streptococci. Leucocytes from a normal rabbit, or those from an immune rabbit, suspended in immune rabbit serum rapidly take up and destroy virulent streptococci. The serum has acquired something in the process of immunization which neutralized something in the cocci, by virtue of which they were protected against phagocytosis.

Denys and Marchand<sup>3</sup> showed that there is better phagocytosis of virulent streptococci when inoculated into a suspension of rabbit's leucocytes in normal rabbit serum, to which had been added 1 per cent. of immune horse serum, than when they were inoculated into the same mixture of leucocytes and rabbit serum, with the addition of 1 per cent. of normal horse serum.

Bordet<sup>4</sup> was able to find no protection against streptococci in normal and in immunized rabbits and guinea-pigs, except that due to phagocytosis. If a rabbit was treated with antistreptococcic serum, and later injected with several times the minimum fatal dose of streptococci, the organisms were all taken up by phagocytes and destroyed. In untreated rabbits he also found phagocytosis, but the organisms soon got the upper hand and the rabbit died of streptococcus infection.

Marchand<sup>5</sup> studied phagocytosis of virulent and non-virulent streptococci, and came to the conclusion that the failure on the part of the leucocytes to take up virulent streptococci depends on a physical property of the organisms and not on a secretion. Tchistovitch<sup>6</sup> injected rabbits intravenously with fatal doses of a highly virulent streptococcus, killed the animals in one-fourth to six hours, and examined the organs for evidence of phagocytosis. He was always able to find some phagocytosis in the lungs and in the liver of these animals, and concluded that this phagocytosis of virulent streptococci may be due to the fact that every culture contains some cocci which are less resistant than others, and that those are the only ones which are taken up by the phagocytes.

Simon<sup>7</sup> found very little evidence of phagocytosis, *in vitro*, when rabbit's leucocytic exudate was inoculated with a non-virulent streptococcus. The washed

2. La Cellule, 1895, vol. xi, p. 177.

3. Quoted from Denys, Centralbl. f. Bakt., 1898, vol. xxiv, p. 685.

4. Annales de l'Institut Pasteur, 1896, vol. x, p. 104, and 1897, vol. xi, p. 177.

5. Archiv de Méd. Exper., 1898, vol. x, p. 253.

6. Annales de l'Institut Pasteur, 1900, vol. xiv, p. 802.

7. Centralbl. f. Bakt., 1901, vol. xxix, pp. 81 and 113.

\* Read in the Section on Pathology and Physiology of the American Medical Association, at the Fifty-fifth Annual Session, June, 1904.

1. Virchow's Archiv, 1887, vol. cvii, p. 209.