The Journal of the American Medical Association

Published Under the Auspices of the Board of Trustees

VOL. LXIII, No. 16

CHICAGO, ILLINOIS

OCTOBER 17, 1914

ANOCI-ASSOCIATION IN RELATION TO OPERATIONS ON THE GALL BLAD- DER AND STOMACH*

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In reviewing the records of 893 operations on the biliary tract and 331 operations on the stomach performed by my associates, Dr. Bunts and Dr. Lower, and myself, together with those performed by other surgeons at the Lakeside Hospital, we find that the clinical course of certain patients after gastric resections and after common-duct operations is similar in many respects. At the time of operation pulse and temperature are normal, but the patient is emaciated and sallow in appearance; his vitality is much reduced; his demeanor is melancholic and he is alternately possessed by hope and despair. After the operation his downward course and exit strikingly resemble the sinking and disappearance of the unwary traveler who has been trapped by quicksand.

Statistics show that no clinic has ever reduced the mortality rate of any considerable series of resections of the stomach below 10 per cent., and the mortality rate of infected, obstructed common-duct operations is scarcely less. When the surgeon is obliged to tell the prospective patient, whose courage has already been lowered by the disease itself, that his chances for recovery from the operation are but one in ten, the patient is naturally reluctant to accept the risk, or else he undergoes the operation in a hopeless spirit which augments the peril.

The purpose of this paper is to offer a probable explanation of this postoperative morbidity and mortality and to discuss a method by which the patient may be steered clear of the metabolic quicksand. The cause of the high mortality of gastric and gall-bladder operations is exhaustion—not the exhaustion induced by trauma and infection, though this may indeed be a contributory cause, but exhaustion which is the result of the lack of function of a fundamental organ.

This postulate is based on experimental as well as clinical evidence. In my laboratory, my associates Dr. J. B. Austin, Dr. F. W. Hitchings and Dr. M. L. Menten have made histologic studies and H-ion concentration tests after the excision of each of the following organs—the liver, the adrenals, the thyroid, the pancreas, and the spleen. Only double adrenalectomy and hepatectomy caused a steadily increasing exhaustion and death in less than twenty-four hours.

These operations were the only ones followed by a marked increase in the hydrogen-ion concentration of the blood, this increase appearing in from a few to twelve hours or more and being the immediate precursor of death. Excision of the liver or of the adrenals also caused marked changes in the brain cells.

We then made histologic studies of every tissue and organ in the bodies of animals exhausted by prolonged insomnia; by infections; by fighting; by physical injury; by fear; by slow etherization and by the injection of toxins, of alcohol, of skatol, etc. In every case, identical changes were found in the brain, the adrenals and the liver, and in these organs only. In brief, exhaustion from any cause is manifested by identical clinical symptoms and by identical histologic changes in the brain, the adrenals and the liver. A given case of exhaustion may have been initiated by the inanition of vomiting; increased by pain; carried further by infection; still further by the strain of etherization; another step by the unblocked traumatism of the operation; until postoperative pain, even if not severe, finally overcame the already lowered powers of endurance and the patient died. According to the margin of safety in the individual patient the fatal sequence may be terminated at any point.

I have stated that three organs are especially concerned in this progressive exhaustion, but the primary significance of one of the three—the liver—in the cases we are considering, may not at first be manifest. One of the most important functions of the liver is the neutralization of the acids which, as our hydrogen-ion concentration tests have shown, are a by-product of energy transformation. Disease processes, emotion, physical injury—every kind of response to stimuli produces acidity. Under normal conditions the liver and the adrenals—which share in the neutralization process—can quickly restore the body fluids to their normal, slightly alkaline condition.

If a starved and worried patient be traumatized, the margin of safety must necessarily be reduced; acidosis will be present or threatened and but a slight additional stimulus will suffice to produce the fatal result. But ether and nitrous oxid anesthesia cause marked acidity in the blood, which normally is neutralized in about thirty minutes; ether, however, adds an adverse chemical effect and a psychic strain. Every contact between instruments and tissue under naked-nerve ether anesthesia causes a discharge of energy and increases the acidity; the postoperative pain stimuli do likewise until at some point the body's stores of energy are exhausted and the liver is no longer able to meet the demand for acid neutralization. Long before the operation is completed, the patient's doom is sealed.

Treatment is of little avail. The administration of sodium bicarbonate and glucose by mouth, of bile by

* Read before the Section on Surgery, General and Abdominal, at the Sixty-Fifth Annual Session of the American Medical Association, Atlantic City, N. J., June 1914.

rectum, and excellent nursing may aid, but in most instances they accomplish little. The only cure is prevention (a) by increasing the store of energy and (b) by stopping the expenditure of energy and the consequent fabrication of acid. The first end may be accomplished by increasing the intake of food and water; by the administration of sodium bicarbonate and glucose, and by having the patient sleep in the open air. Energy may be conserved by limiting physical activity and so far as possible eliminating worry and anxiety before the operation; and by diminishing acid production during and after the operation by complete anoci-association.

With the starved patient no anesthetic and no narcotic is safe. Anesthetics increase acidity in a direct ratio to the amount given; morphin does not increase acidity but does interfere with neutralization. Psychic quiet for these patients may be safely secured by bromids administered per rectum. Just enough nitrous oxid should be administered to give a twilight anesthesia so that the patient may be protected against the destructive action of fear. The infiltration of novocain in 1:400 solution precedes each division of nerve-bearing tissue. An ample incision is made and a feather-edge technic is employed throughout the operation. To insure complete relaxation during the operation and to promote postoperative comfort the abdominal wall at a distance from the incision is thoroughly infiltrated with quinin and urea hydrochlorid in 1:600 solution.

If the margin of safety is very narrow the operation is performed in two stages. For example, a gastro-enterostomy is followed by gastrectomy after the nutritional balance has been restored; or in a case of common-duct obstruction with infection, the gall-bladder is first drained until the jaundice disappears and the margin of safety is enlarged, when the stones may be removed safely.

Another great danger in gall-bladder operations is interference with the function of the liver by injuring its nerve supply. In our experiments we found that blocking the nerve-supply to the liver caused histologic changes. We found also that when the splanchnic nerves are roughly handled the brain cannot control the epinephrin output.

A sharp knife, bloodless dissection, the elimination of pulling and tearing manipulations and a minimum amount of sponging are required. Because of the very slight insulation of the splanchnic nerves, their injury is surprisingly easy; for this reason also, therefore, the two-stage operation is advisable in critical cases, as thus a smaller number of splanchnic nerves will be injured at one time and the interference with the functions of the already almost overwhelmed liver and adrenals will be diminished.

These deductions are based not only on laboratory experiments but on clinical observations as well. Since I have begun to apply these principles in gall-bladder and stomach operations I have seen a remarkable improvement in the results.

The postoperative care of these patients is of vital importance. Skilful, tactful nurses by creating an innocuous environment can most valuably second the efforts of the surgeon who, in the patient's room as clearly as in the amphitheater, visualizes the clinical problems which his special case presents.

A brief word may well be added concerning the danger of postoperative pneumonia. This danger may be almost eliminated by discarding ether and by the infil-

tration of quinin and urea hydrochlorid at a distance from the wound. The tendency of ether to cause bronchitis and pneumonia is generally recognized. Pneumonia does not result from the use of nitrous oxid oxygen. Even without ether, however, a painful wound may in itself cause pneumonia. When a wound in the upper abdomen is painful, the respiratory excursions are inhibited; the lung is not expanded, and pleurisy and pneumonia are the natural result. The painless wound which is assured by the use of quinin and urea hydrochlorid will, therefore, prevent postoperative pneumonia.

The complete application of the principle of anoci-association, not only during the operation but also in the preoperative and postoperative care of the patient, will minimize the two greatest dangers attending gall-bladder and stomach operations—exhaustion with its fatal sequel, acidosis, and postoperative pneumonia.

Osborn Building.

ABSTRACT OF DISCUSSION

DR. W. D. HAGGARD, Nashville, Tenn.: We are greatly indebted to Dr. Crile for the elucidation of factors of which we have evidently been hitherto unaware. We have been so engrossed with the pathology that it may be said we have been pathologically wise, but physically foolish; but Dr. Crile has joined the experimental with the practical. Gentle manipulations and extreme care should be used particularly in those cases in which the great primitive organs of the body are concerned. We learn from surgical associates, of patients with chloroform poisoning who die on the fourth and fifth day without apparent cause. The blood-count is just like that in phosphorus poisoning. So we find that in surgical deaths when this drug is not used the important function of the liver has been interfered with. We seem to forget that the sympathetic nerve controls the liver and in our operations on this organ and the common duct, a perfectly mechanical thing, our mortality has been frightful because we have ignored the fact that, if we destroy the innervation of this big center of the body, we not so much destroy the patient's resistance as inhibit his opportunity for recovery. I was glad Dr. Crile referred to the gall-bladder as he did, because we have had the pendulum of opinion going to and fro, some thinking that if the gall-bladder is lost our landmarks are gone. I had this experience in an ordinary inflamed gall-bladder which I left in. I had the intense chagrin of seeing that patient develop malignant neoplasm of this retained gall-bladder. An experience of that kind does much more to shape our course than any theorizing. When put to the test of analysis, how unwise it seems to leave the thickened, inflamed gall-bladder which is already functionless and out of commission. Why not remove it so that the patient can have the benefit of immediate and permanent recovery? Our generation will scarcely appreciate keenly enough the remarkable addition to our therapeutic resources that have come from the elaborate and convincing studies presented by Dr. Crile and his associates.

DR. ERNEST LAPLACE, Philadelphia: So eminent a man as Sir Berkeley Moynihan said in my presence that Dr. Crile's work was the greatest thing in surgery since the work of Lister, and I believe it. For years I have taught that there was but one kind of shock, and that traumatic, emotional, chemical or physical shock must produce the same material results. It remained for Dr. Crile to prove that assertion. The logical sequence to this has been the birth of anoci-association with the wonderful improvement in the operative recovery of patients. Hence, we must diminish the causes of shock. Mechanical interference and tampering with the peritoneum, especially in the region of the gall-bladder and liver, is probably one of the greatest additional causes of shock. Gall-bladder surgery just now is undergoing the same course that appendiceal surgery went through some

years ago. The gall-bladder is a diverticulum like the appendix which should be removed if it has ceased to serve its purpose. Gall-stones likewise should be removed with the least shock-producing procedures, quickly, and with the least interference with the peritoneal cavity leading to anoci-association. With that object in view I have devised a simple liver retractor. In removing the gall-bladder the liver was formerly lifted by the hand of an assistant. Instead, I now lift the liver with a long smooth wire retractor while the gall-bladder drops into a forked space in the center of the retractor. This facilitates the dissection of the gall-bladder and affords a better view of the gall-ducts and neighboring structures. This is a step in carrying out the shockless operation, as it facilitates and expedites the work.

DR. ROBERT T. MORRIS, New York: Dr. Crile has reduced to analysis principles I have held for many years. The principles of the fourth era of surgery I stated very crudely, but at least felt clinically the experience that was giving this trend, and expressed it in various ways. I taught for many years the crude outline form of anoci-association. Many of us have been doing the same thing. Dr. Crile has simply given us a refined product because of his philosophic method of work; synthesis in association with his scientific analysis.

DR. ALBERT J. OCHSNER, Chicago: If we go home with the valuable principles which are at the bottom of the remarkable clinical success of Dr. Crile's work, and with a thorough appreciation of the fundamental principles, we will be the gainers. The fundamental principle is, in the first place, to widen as much as possible the margin of safety. The various things that Dr. Crile does in his practice inspire the patient with confidence, making him feel that he is in the best hands under the conditions in which he exists. Everything is favorable, the patient is in the hands of nurses who know that things must go well after Crile has finished the operation. Every surgeon should introduce this element and carry it out in his work. He should not do his work where forty other surgeons are doing bad surgery. The second principle is that none of this margin of safety should be wasted. There is neither insane haste nor imbecile deliberation in Dr. Crile's work. His surgical judgment indicates what should be done and after he is through with the operation the best possible and nothing harmful has been done. Another fundamental principle is that all the useless things done must be harmless; for instance, introducing quinin and urea hydrochlorid. This is one of the useless things, a little of which will do the patient no more harm than any one of many other useless things. Many Christian Scientists have come to me for operation. I have found that one of these patients will do better after an operation than another patient after the same operation, simply because that element of waste is eliminated. The value of faith in the remedial element I saw illustrated some twenty-five years ago when I was chief assistant to Charles T. Parkes. A visitor after a week with us said it was wonderful that our anesthetics went so quietly, that we had no vomiting, that the patient's condition was perfect throughout the anesthesia. "How do you do it?" Dr. Parkes replied, "We give morphin $\frac{1}{4}$ grain and atropin $\frac{1}{100}$ grain half an hour before the anesthesia is begun." A nurse who heard this came to me and said, "I have been on duty for a year and a half and I have never given this. Is it possible that I should have known this and that I was not informed when I undertook this work?" We had no cyanosis during the anesthesia; we had almost no postoperative pneumonias. A man from the East came to my hospital with a remedy which was intended to stop postoperative vomiting. He told a very plausible story. I instructed the superintendent of nurses to use this in every case of postoperative vomiting. Some time later I asked her whether the remedy was doing what was claimed for it. She replied, "We have had no postoperative vomiting." Now if I had done some useless thing, so long as it was harmless, it would have seemed good practice, and it would have been most natural to attribute the good results to this factor.

DR. CONRAD A. HOWELL, Columbus, O.: No one follows out the principles which Dr. Crile has endorsed more than I. It was from Dr. Crile that I first got the impelling motive to use his technic and the principles involved in anoci-

association. So much have I been impressed with the necessity of rest, both mental and physical, that a patient who goes into a hospital the night before the operation is made to sleep under the influence of veronal. I consider ten or twelve hours sleep the *sine qua non* for the operation which is to take place next morning. I can readily imagine what the thought would be that every tick of the clock means a second nearer the time set for the operation. As to the use of narcotics, morphin, hyoscin, I do not use them as was suggested by Dr. Ochsner. My operating hour is 9 a. m. The veronal which was administered the night before keeps my patient asleep until 7 a. m. At 7, dependent on the physical characteristics of the patient, I order morphin $\frac{1}{8}$ grain, hyoscin, $\frac{1}{200}$ grain, and at 8 I repeat a similar dose, with the object of keeping the patient's mentality, his cerebral centers, in a completely sedative state until 9, the time set for the operation, and not in that raspy, keen pitch, which would be the case if these narcotics were administered only one-half hour before he is to be operated on. Veronal the night preceding the operation, morphin and hyoscin at 7 and 8 keeps the patient in a tranquil condition from the time he wakes until the time of operation. The morning hour is the time for operating, not the afternoon—the morning hour when the patient has been refreshed by sleep, when there has not been a long interval between the time of waking and the time set for operation. With regard to quinin urea hydrochlorid, do not use it strong (1 per cent.). Do not use it near the skin. It produces a fibrinous exudate which strangulates the blood-vessels supplying the skin and will cause a slough. Use it deep in the muscular structure; use it in the parietal peritoneum. I cannot agree with Dr. Crile when he says that he puts patients to bed and gives them bromids because, using quinin and urea hydrochlorid in the strength which I do (1:400), I must confess that the patient still suffers pain, though not the amount that would be present without the use of that drug. I believe that pain breaks down cerebral cells if kept up for hours after an operation, and tends to produce shock; therefore I use morphin in small doses as a postoperative adjunct.

DR. GEORGE W. CRILE, Cleveland: We never give morphin to a very old or very young patient, or to one who is very sick. We do give morphin grain $\frac{1}{8}$ and scopolamin grain $\frac{1}{150}$ to patients who are not debilitated. After the operation we do not hesitate to give morphin again, in small doses. We also use novocain. It does not interfere with the healing of wounds. Quinin and urea hydrochlorid injected into the skin does produce a marked reaction in the tissues, but, as Sir Berkeley Moynihan states, if quinin and urea hydrochlorid is injected at a distance from the wound itself it will interfere with healing no more than any other manipulation does. When quinin and urea hydrochlorid in 1:600 solution is injected at a distance from the wound it does not come in contact with the wound itself. Of course whether quinin and urea hydrochlorid will ultimately prove to be as valuable as we now think it is, will be determined by the testimony of the patients.

Challenge to Christian Science.—The following proposition was made at a lecture on Christian Science by J. W. Springthorpe, Melbourne, Australia (Therapeutics, Dietetics and Hygiene, ii, 651): "Leaving the abstract for the concrete, I will now undertake to demonstrate to the local coterie of Christian Scientists that their minds do not dominate their own bodies, much less the bodies of others, and I will do so with drugs, which they say are powerless. Thus with one drug I will make their president speechless and motionless; with another I will make their vice-president red all over or perspire horribly, whichever she dislikes most; with a third their treasurer the sickest possible in the time; and with a fourth their secretary unable to read her 'Bible', though she shall still see the book. Surely here is real 'fruitage'—or failure." Needless to say, the challenge, though reported to headquarters, was not taken up. It is hardly necessary to add that chloroform, amyl nitrite, pilocarpin, apomorphin and atropin would have produced the effects mentioned.