

ciation and by the Germans, a committee on anesthetics, which will present to this Section a report of the studies and progress made each year in this important field of work. The chairman will entertain a motion that such a committee, say of three or five, be appointed and that Dr. Lund, the representative of this Section in the House of Delegates, ask for a sum not to exceed \$500 for the coming year to forward this work.

Original Articles

LOCAL ANESTHESIA IN GENERAL SURGERY.*

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During the past few months, in a comparatively small radius, I have known of five deaths directly attributable to general anesthesia. In two instances chloroform was the anesthetizing agent, in two ether and in one somniform. These represent a relatively small number of cases. If there were included those indirectly attributable to general anesthesia, through pneumonia, shock and renal complications, the proportion would surely be greater. It is probable that if all instances of death directly due to the anesthetic were known the rate would be much higher than that ordinarily given, that is, 1 in 1,000 for chloroform, 1 in 10,000 for ether, and 1 in 100,000 for nitrous oxid.

Were it possible to have in every hospital a skilled anesthetist whose duties consisted only in the administration of anesthetics, the question would be simpler and the danger would undoubtedly be lessened. For many reasons this is impossible in the majority of hospitals where the ever-changing resident staff necessitates the frequent training of a new anesthetist. It is under such circumstances that my own work is done, and it is under just such conditions that the great value of local anesthesia can be best appreciated.

Operations under local anesthesia naturally consume a greater amount of time, and so in busy clinics or crowded amphitheatres where rapid work is expected general narcosis is a necessity. In private practice the feeling of assurance, that at the close of the operation the danger of complications is lessened, more than repays one for the extra time consumed. While, as has been shown by Mikulicz, postoperative pneumonia may occur after local anesthesia, it must be exceedingly rare, and in my experience has not been once encountered. The danger of shock is lessened and urinary disturbances are infrequent. Haste is not essential and the lack of trained assistants not so keenly felt.

We owe to Halsted the introduction of local anesthesia in this country. After his work and that of Corning in 1884 and 1885 local methods, taken up for a time, fell into disrepute because of reported cases of poisoning due to the use of strong solutions of cocain. Reclus and Schleich did much to overcome this prejudice by the introduction of weaker solutions. In recent years, however, many improvements have been made in technic, chief of which are the injection of nerve trunks and the addition of adrenalin to solutions. Numerous substances are available, but none seems to satisfy all the conditions as well as cocain, and in an extensive experience in its use I have never seen any bad effects from it. It is a

protoplasmic poison, forming with protoplasm an unstable compound which breaks down slowly, after which the tissues return to their previous condition and resume their normal function. Cocain which has exerted its anesthetic action and has entered into this combination can not be absorbed into the circulation, and, therefore, poisoning can be due only to absorption of an excess. The toxic dose of cocain varies with the concentration of the solution in which it is administered. Interruption of the blood stream is an absolute safeguard against poisoning, and the addition of adrenalin to solutions, as first recommended by Elsberg and Barker, has practically abolished all fear of cocain poisoning.

During the past year I have had tablets of cocain and adrenalin prepared according to the formula of Braun, which contain cocain hydrochlorid 0.05 gm. and adrenalin 0.00016 gm. These are sterilized by dry heat for an hour on three successive days and can then be preserved indefinitely. By dissolving a tablet in sterile physiologic salt solution a perfectly fresh and isotonic solution is obtained. Only two strengths are necessary, viz., a 1 per cent. solution for nerve blocking and a one-tenth of 1 per cent. solution for ordinary infiltration. I have found the skin anesthetic for the placing of sutures three hours after infiltration with the 1 to 1,000 solution. The two ordinary methods—infiltration and nerve blocking—are used to the greatest advantage in combination, or to both may be added a few whiffs of a general anesthetic to tide over important or painful stages of an operation. Not only is general anesthesia well borne under these conditions, but general narcosis is obtained with a very small amount of the anesthetizing agent.

That local anesthesia has never become popular in this country is probably due to the fact that it necessitates slower work and a greater expenditure of time. The surgeon is apt to look on the method as one which is mainly useful for minor surgical procedures, and does not feel inclined to waste time and trouble in carrying out extensive operations which can be accomplished with so much less effort under general anesthesia. Familiarity and experience tend to increase one's faith, a definite ease is acquired by practice and the field of application steadily broadens. Success depends on experience and special training and on an intimate knowledge of sensory nerve distribution.

The operator must have the confidence of his patient and must work with patience and care, avoiding haste and using the utmost gentleness in the handling of tissues. Especially is this important in the early stages of an operation; for pain at this point causes, on the part of the patient, a loss of confidence which can not be recovered. No definite criterion can be laid down for the application of local anesthesia. In general it is available wherever the whole field of operation can be rendered anesthetic. Sensibility to pain varies much in individuals, and in children or hysterical persons little can ordinarily be accomplished, although I have operated successfully on a girl of 9 years for typhoid perforation, and in a boy of 7 have drained the gall bladder. In extensive dissections for malignant disease local methods are to be condemned.

In looking over the statistics of the hospital service during the last three years, I find a constantly increasing proportion of operations done under local anesthesia. In the service of January, February and March, 1907, 40 per cent. of all operations have been done with cocain alone, and an additional 12 per cent. with cocain

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assisted by a little chloroform or ether, making in all one-half performed with the aid of local anesthetics. These operations include amputation of limbs, wiring of fractures, excision of glands of neck and groin, excision of rib for empyema, trephining, osteotomy, thyroidectomy, excision of breast, excision of varicose veins of leg, perineal urethrotomy, suprapubic cystostomy, circumcision, excision of hemorrhoids and fistulae, exploratory laparotomy, cholecystostomy, appendectomy, colostomy, suture of typhoid perforation, radical cure of hernia, varicocele and hydrocele and numerous minor procedures. Many of these have necessarily been in selected cases, but in certain operations local anesthesia has become the routine method, and repeated experiences have developed useful improvements in technic.

A very extensive dissection of the neck is possible under local anesthesia by taking advantage of Crile's method of nerve blocking. For the excision of glandular areas in malignant conditions local anesthesia is not recommended; but we have on several occasions in very old and feeble individuals excised the submental and submaxillary glands without any difficulty. One complete excision of all the glands of the neck for tuberculosis was accomplished in a young colored girl. Through a small incision the cervical plexus was blocked at the posterior border of the sternomastoid muscle, giving an extensive area of skin anesthesia. The skin incision was then completed, the sternomastoid and omohyoid muscles divided and a complete dissection made with very little discomfort to the patient, the deeper tissues being injected as they were encountered.

Although the number of thyroid cases has been small (14 cases), I have never resorted to general anesthesia. The transverse collar incision has been used in all and the tissues injected as encountered. Recently I have found that, by extending the skin incision to the posterior border of the sternomastoid muscle and early in the operation blocking the cervical nerves as they emerge, the dragging pain in the neck caused by the delivery of the thyroid gland can be practically eliminated. These patients have all stood the operation well. There have been no after-effects and no fatalities.

In the wiring of fractures our experience has been confined to the clavicle, the olecranon process, the patella and the lower jaw. We have accomplished these without any difficulty. In several cases we have chiseled off osteophytes from the long bones, and in one instance have completed an exploration of the cranium with the trephine. The removal of a section of rib for drainage of the pleural cavity we have always done with cocaine, except in very young children.

For the radical cure of inguinal and femoral hernias, Cushing's method is so satisfactory that we feel that general narcosis is never necessary, and with strangulation it is contraindicated. During the last four years we have used a general anesthetic but twice for this operation in adults, in both instances because the patient positively refused to consider the local method. During this time in a large series of cases it has never been found necessary in a single one to resort to the aid of even the smallest amount of a general anesthetic. A preliminary dose of morphin is given about half an hour before the operation and Cushing's technic is followed. An early injection about the neck of the sac and the inguinal ring avoids all pain during ligation and excision of the sac and handling of the cord and testicle. The size of the hernia matters little. The operation is usually completed without the slightest complaint and

in several instances the patient has fallen to sleep during the course of the operation. We had previously thought that recurrent hernias demanded general narcosis, but recent experience has shown that by extending the incision a little higher and blocking the ilioinguinal and iliohypogastric nerves above the scar the operation can be carried out with as great ease as in ordinary cases.

In femoral hernias the incision is begun over the lower part of the inguinal canal, the fibers of the external oblique muscle are separated for a short distance and the nerves blocked. We have found by this method that the operation is practically painless. The oldest patient of this group on whom we have operated well illustrates the advantage of local anesthesia. A woman of 92 was seen on the eighth day of strangulation of a moderate sized femoral hernia. Without removing her from bed an incision was made as described above and a loop of gangrenous small intestine brought out on the abdomen. After a few hours this was opened and the bowel washed out. On the following morning, the patient's condition being remarkably improved, the gangrenous portion of the bowel was cut away and an end-to-end anastomosis done by means of a Murphy button. Her bowels moved naturally forty-eight hours later.

Small umbilical hernias are always done under local anesthesia, and in very large or postoperative hernias we have used with great success the combined cocaine-chloroform method. Quite recently I was able to complete the cure of an enormous postoperative midline hernia containing large and small intestine and adherent omentum. The repair was done by the overlapping method. A 1 to 2,000 cocaine solution was used until the sac was opened. During the separation of the adhesions and the return of the contents of the sac to the abdominal cavity whiffs of chloroform were given. The patient was never fully unconscious and was talking rationally during the closure of the wound. The operation lasted nearly three hours, during which time there was no variation in the pulse rate.

In all scrotal operations, the radical cure of hydrocele and varicocele, the field of operation can be so well anesthetized by nerve blocking through the high hernia incision that a general anesthetic is never considered. We have completed Whitehead operations without the slightest pain, and in all the lesser operations for hemorrhoids and simple fistulae and fissures local anesthesia is our routine method.

It is in abdominal surgery that experience is of the greatest value in familiarizing one with the painful manipulations which are to be avoided—traction on the mesentery and disturbance of the parietal peritoneum. All of the abdominal wall incisions can be accomplished with ease, separation of the rectus fibers being the simplest. A satisfactory exploration can usually be made, and naturally those viscera in apposition with the parietes are most available for operation. Colostomy and simple enterostomy are always practicable. In typhoid perforation local anesthesia has been used in every instance (9 cases), and only in the first two was it necessary to resort to general anesthesia for the completion of the operation. In typhoid cholecystitis I have walled off and drained the gall bladder successfully. I have been able to complete an appendectomy seven times, twice in the presence of an abscess, but local anesthesia is to be recommended only in selected cases with mild symptoms or when there are strong reasons for avoiding general narcosis.

The healing of wounds has been uniformly good. I have never seen sloughing of the skin and there have been no cases of suppuration, and Bodine's statement that the gentler handling of the tissues is responsible for these results offers the probable explanation.

A most interesting experience has been in the observation of the sensibility of various tissues; for a knowledge of the variations in sensibility is the keynote to success. In general our results have served to support the findings of Lennander and Braun. The skin being thoroughly anesthetized and the incision made, there is little sensation in the subcutaneous tissue and muscles as long as blood vessels, large nerve trunks and connective tissue bundles are avoided. Periosteum is exquisitely sensitive, but when it has been cocainized the bone beneath has no sensation. This we have well demonstrated on the skull in a case of trephining. An incision was made under cocain infiltration and the scalp retracted. The periosteum was exposed and an attempt at incising it caused great pain. It was injected with 1 per cent. cocain solution and reflected from the bone. A one-inch trephine opening was then made and the button lifted out. The patient felt no pain. The dura was incised without pain. The brain cortex was touched with gauze and with instruments and there was no sensation whatever. When seen in the ward half an hour after the operation, the man was sitting up in bed reading a newspaper.

The same insensibility to pain in bone has been noted in several cases of amputation, in the removal of osteophytes and wiring of fractures. In every instance after thorough cocainization of the periosteum, the actual manipulations of the bone itself have been unaccompanied by pain. The patients have stated that they could feel and hear the sawing, but it was as if a board were being sawn while resting upon some part of the body. The synovial membranes of joints have proved exquisitely sensitive.

In the abdomen numerous observations have corroborated the statements of Lennander: that the parietal peritoneum is sensitive, while the visceral peritoneum and the viscera, even in the presence of inflammation, are not. We have found time and again while operating under local anesthesia that, as long as the parietal peritoneum is not disturbed by actual contact or by traction with instruments or through the mesentery, there is no complaint of pain. On the other hand, the slightest touch to the parietal peritoneum brings forth a complaint, and in inflammatory conditions this sensibility seems to be increased. Manipulations of the viscera, causing tension on their mesentery and thus on the posterior parietal peritoneum, cause not only pain, but a sensation of nausea, and I have seen actual vomiting occur.

The point to which the pain is referred is interesting. Whereas clamping, crushing or burning across the appendix causes no sensation whatever, the pulling on its mesentery incidental to its ligation produces a sensation of nausea and causes the patient to complain of pain, not in the region of the appendix, but in the epigastrium, suggesting an explanation for the early pain of appendicitis so often noticed in this region. In the same way I have noticed in one instance that traction on the gall bladder caused a complaint of pain in the right shoulder, and in another case distension of a gall bladder with fluid through a fistula produced the same result. I have exposed the right lobe of the liver and opened an abscess in it with the Paquelin cautery with-

out pain. In the case of the kidney also we have shown to our own satisfaction that there is no sensation in its substance. In order to exclude the possibility of drug interference with the sensibility of the viscera and the visceral peritoneum, I have recently carried through a few explorations of the abdomen, omitting the preliminary dose of morphin and the cocain, the abdominal incision being made by means of infiltration with physiologic salt solution. Two facts were demonstrated by these operations: first, the importance of cocain in, however small proportion in the anesthetizing solution, and, second, the marked contrast between the sensibility of the parietal and the visceral peritoneum. The findings in these cases were exactly the same as when cocain was used. I append abstract of two of these cases.

CASE 1.—Exploratory laparotomy for suspected carcinoma of stomach. No preliminary dose of morphin was given. The man was placed on the operating table and the field of operation prepared. With physiologic salt solution, a wheal was produced in the skin as in the ordinary procedure with cocain, except that the wheal was made much larger in order to produce greater tension. The skin was incised through this wheal. The production of the wheal caused no discomfort, but the incision elicited a complaint of pain, in striking contrast to an incision made under cocain infiltration. The anterior sheath of the right rectus muscle was opened and the muscle fibers separated. The posterior sheath and peritoneum were opened in a similar manner and a clamp placed on either edge of the parietal peritoneum. The patient complained bitterly at each step of the incision, and when the peritoneum was clamped cried out with pain. All manipulations were now discontinued for some time, allowing a rest, until the patient said he felt perfectly comfortable. The omentum was then picked up with a clamp, care being taken to avoid the parietal peritoneum. The omentum was clamped and then torn slightly till a bleeding point necessitated the placing of a ligature. In reply to questions the patient stated that there was no sensation. The transverse colon was seized with a clamp and pinched till a distinct imprint of the serrations was left on its surface. The patient said he felt nothing. A clamp was placed on the suspensory ligament of the liver; there was no sensation. The colon was held and its surface rubbed with gauze; there was no pain. Traction was made on the omentum and on the colon and the patient complained of pain. Traction on the suspensory ligament of the liver also caused pain. The parietal peritoneum was rubbed gently with gauze, the patient immediately tightening his abdominal muscles and crying out with pain.

CASE 2.—Large irreducible right inguinal hernia in colored man. No preliminary dose of morphin was given. The skin was infiltrated with salt solution and an incision made extending somewhat below the external ring. The injection was made rapidly and as thoroughly as possible, producing a wheal much larger than that customary with cocain. The anesthesia produced was slight, the patient complaining as the incision was made. The sac was opened for a distance of several centimeters, the patient complaining as the peritoneum was cut. Small intestine presented and protruded into the wound. After a few minutes' rest, when the patient expressed himself as feeling perfectly comfortable and free from pain, the intestine was seized with a clamp, rubbed with gauze and pricked with a needle. There was no pain, no sensation whatever. The intestine was gently lifted out of the sac without traction, was handled with instruments, with the fingers and with gauze without producing any sensation. When the intestine was further withdrawn so that the mesentery was stretched, the patient complained of a dragging pain and nausea. At this point the skin was injected with 1 to 1,000 cocain plus adrenalin and the incision prolonged upward. The external oblique muscle was divided and the ilioinguinal and iliohypogastric nerves injected with 1 per cent. solution of cocain. The operation was then continued. Just before closing the sac the appendix was inspected and its removal advised, to which the

patient consented. The appendix was seized with a clamp and brought through the internal ring into the wound and its base exposed without any difficulty. Traction on the appendix caused the patient to complain of a dragging and nauseating pain which he referred to the region of the umbilicus. The mesentery of the appendix was ligated with fine silk and divided. The tightening of the ligature caused the pain described above. A cuff of the outer coats of the appendix was turned back about its base, and in reply to a question the patient stated he felt nothing. Care was taken during this procedure to avoid traction, the cecum lying in place at the internal ring. The base of the appendix was clamped, crushed and burned across with a cautery; there was no sensation during the procedures. A purse-string suture was placed about the base of the appendix in the cecum, turning in the stump of the appendix. There was no pain. The small intestines were again tested with negative findings as to sensibility. The edge of the sac was now clamped and drawn on, bringing forth a complaint of the same dragging and nauseating pain. The operation lasted in all two hours, and was completed without any further complaint. The pulse at the beginning was 60 and at the close of the operation was 60. The highest pulse rate was 70. This occurred when the skin incision was made under salt solution infiltration and during the division of the neck of the sac, and again during traction on the mesentery of the appendix.

PREPARED AND PREDIGESTED FOODS.*

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Economists tell us that in the struggle for existence a quarter of the income of a civilized family is paid out for lodging, a quarter for clothing and a half for food. The savage, who requires neither clothes nor modern lodging, expends his economic force in the capture of game and the raising of corn. In view of the physical well-being of savage races and of ignorant peoples throughout the world, it must at once be apparent that the normal instinct of appetite is a faithful guide for the nutritive requirement of mankind.

There will be no escape from the judgment, "By the sweat of thy brow shalt thou eat bread," until some one realizing the dream of Berthelot shall perfect a cheap process for the manufacture of veritable ambrosia from sawdust. Emil Fischer has been pictured in a cartoon as the master of a food factory located at a coal mine. Fischer, however, remarks that he who would eat his synthetically prepared sugars and peptones must, indeed, be a wealthy person.

Man is a machine developing mechanical energy and producing heat at the expense of the potential energy contained in fat, starch and proteid. A widespread error is that this requirement for energy is variable and may be largely reduced by diminishing the intake of food. Such a belief on the part of a healthy man is automatically corrected by his appetite, leading him to eat more bread for example. But where the individual is under the care of a physician, taking his food by the physician's orders, the food requirement of the body should be very clearly understood.

Two points stand out boldly in this connection. In the first place there must be sufficient proteid food ingested to protect the organism from proteid loss, and secondly there must be given a sufficient heat value in fats or carbohydrates to protect the body fat of the person and prevent emaciation. As regards the proteid requirement, it has been found by many investigators that

the average fasting man eliminates 10 grams of nitrogen in his urine, which corresponds to a destruction of 62.5 grams of proteid or the equivalent of about 300 grams of meat per day.

After prolonged fasting with extreme emaciation the nitrogen in the urine may sink to 5 grams or half what it was at first. In the case of starvation, proteid metabolism furnishes about 15 per cent. of the total fuel required by the organism and the remaining 85 per cent. is obtained by burning the body's fat. If carbohydrates be introduced alone into the circulation of a man who previously has been fasting the proteid metabolism is considerably reduced. It has also been found that where a mixed diet rich in carbohydrates is given containing 60, 50, or even 25 grams of proteid, a loss of body proteid may be prevented. In other words, the nitrogen contained in the proteid ingested is exactly eliminated in the excreta without any draft on the body's own proteid store. Such a condition is known as nitrogen equilibrium.

I do not wish to be misunderstood as commending these possible minima of proteid ingestion as being the most desirable, but I am citing the work of Chittenden and others only to emphasize the minimum of proteid ingestion below which waste of body proteid ensues. I agree with Meltzer in the idea that such a minimum is below the "factor of safety."

Passing now to the second consideration, the fuel requirement of the organism, it has been found repeatedly that a fasting man at light work and weighing 70 kilograms produces 2,240 calories of heat or 32 calories per kilogram in twenty-four hours. This is the fasting man's requirement of energy. It may be otherwise stated as being that quantity of heat capable of raising 22.4 liters of ice cold water to the boiling point. If this person were fed on a mixed diet his requirement of energy would be raised from 32 to 35 calories per kilogram of body weight. It is, therefore, apparent that food only slightly increases heat production. If too much food be given it is retained in the body; if too little, the body substance is attacked to make up the requirement of energy. It must, however, be remembered by the physician that in the case of persons confined to their beds this requirement falls to 1,750 calories, or 25 calories per kilogram, since equable temperature and muscular rest reduce the amount of needed fuel.

Ignorance of the unremitting demands of the organism for a definite quantity of dynamic energy leads to great error. I have in mind a diabetic woman whose physician told her to take a "proteid diet" without telling her to take 200 grams of fat as well, and who as a result lost 105 pounds in three months.

As concrete examples of a ration covering the energy requirement of the normal organism it may be said that two pound loaves of bread contain 2,390 calories and 64.4 grams of proteid substances, while four quarts of milk yield about 2,400 calories and contain 140 grams of proteid. The bread costs 10, the milk 20 cents. It is evident that this quantity of fuel for the human machine is not to be compressed into insignificant pellets. The ration of dried meat called pemmican, and of half a pound and more of fat, represents the most concentrated arrangement of fuel value and is used by travelers in polar regions.

The mention of bread, or of milk, or of bread and milk, as a constant dietary arouses at once the feeling of personal distaste. Bread and milk are easily digest-

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