LOCAL ANÆSTHESIA.[1]

BY F. GREGORY CONNELL, M.D.,
OF LEADVILLE, COLORADO,
Surgeon to St. Vincent's Hospital.

LOCAL anæsthesia is usually accomplished by means of freezing or by the injection of cocaine or one of its analogous preparations.

Freezing may be effected by the application of ice and salt, or the ether or rhigoline spray, or, better, by spraying the parts with ethyl chloride or some of its modifications, which may be procured in suitable containers of either glass or thin metal provided with a capillary tube as an outlet.

The low boiling point of these fluids is responsible for the fact that they are always under pressure, and the simple removal of the screw-cap or the turning of a stop-cock will allow the escape of the fluid in the shape of a fine spray, which may be directed against the site of the proposed incision, and its rapid evaporation cause a freezing of the tissues.

Anæsthesia may be affected by this method in less than a minute, and may be continued for a much longer time by the continual application of the spray as the deeper structures are disclosed. But frigorific anæsthetization will be found to be most unsatisfactory. In cases where a dissection is necessary, it is very disappointing after the skin incision, owing to the changes in the tissues caused by the freezing, which make the recognition and manipulation of the structures quite difficult.

In the more simple cases, such as the opening of an abscess, the instantaneous pain caused by the incision of the unanæsthetized skin will be found to be but trifling, as compared with the pain and burning sensation caused by the freezing, and then in turn the thawing, of the tissues.

[1] Read before the Colorado State Medical Association, October, 1903.

As a rule, it may be said that the spray of ethyl chloride will be the cause of more pain and discomfort than will a simple incision. In a large number of minor operations in which ethyl chloride was employed as the local anæsthetic by the writer, great pain was experienced both during the freezing process and afterwards; the incision, or the operation itself, caused no pain, and in practically all of the cases the incision was made and the pus evacuated, or the operation completed, before the patient was aware of the fact, but the pain afterwards, during the thawing, was many times very severe.

The more common and satisfactory manner of producing local anæsthesia or analgesia is by the subcutaneous injection of a solution of cocaine or some of its succedanea.

Cocaine, as an anæsthetic, was first employed almost exclusively in ophthalmology, and was first presented to the profession by Koller, of Vienna, at the Ophthalmic Congress of 1884, at Heidelberg. The anæsthetizing action of the drug is supposed to act in part by the anæmia produced by the stimulation of the vasomotor constrictors, and in part by a paralysis of the end organs of the sensory nerves. Cocaine is by no means the only substance used for the production of local anæsthesia by injection; in fact, there are many, such as Eucaine A, Eucaine B, Tropocaine, Nirvanin, Orthoform, Anæsthesia, Holocain, etc.

The chief reason for such a large number of substitutes is the danger of systemic poisoning from the absorption of cocaine. The toxic effect of cocaine varies considerably, but the usual and chief symptoms are such as, loss of speech, blindness, nausea, vomiting, and syncope. Vertigo is often the first symptom, and may sometimes be followed by convulsions. The pulse and respiration often become very irregular and rapid.

Out of 250 reported cases of accidental poisoning with cocaine, thirteen terminated fatally.

The treatment consists of ammonia, coffee, strychnine, ether, alcohol, morphine, and dorsal decubitus, if collapse threatens, while, if of the convulsive type, amyl nitrite, bromide, chloral, etc., are indicated.

In order to prevent such untoward effects, and at the same time to prevent the action of the drug injected from being too evanescent, it is advisable to constrict the limb or the part of the body into which the injection is to be made.

The addition of adrenalin chloride to the anæsthetic solution is recommended as a precaution against the occurrence of such symptoms. But such accidents should not occur, at the present writing, after the efficiency of the weaker solutions has been demonstrated, and the use of practically non-toxic surrogates of cocaine has succeeded that of cocaine itself.

The most rational treatment consists of prophylaxis, *i.e.*, the employment of non-toxic substitutes for cocaine, or if cocaine proper is preferred, it should be used in very dilute solutions.

Or if, for any reason, the older and stronger solutions are employed, it should be an arbitrary rule never to inject more than one-quarter grain of cocaine at one sitting, although some authorities give one grain as the maximum dose.

In a recent series of fifty cocaine injections for analgesia in various pathological conditions, evil effects were noted in three instances.

1. Epithelioma removed from the hand of a woman sixty-six years of age. She became delirious and talked incoherently, pulse and respiration became rapid. After the wound was closed she was put to bed and given strychnine hypodermically; in about half an hour she became perfectly rational, but could remember nothing that occurred at the time of the operation.

2. Ganglion removed from the hand of a young woman nineteen years of age. Without any premonitory symptoms, she suddenly complained of dizziness, and almost immediately became unconscious; her pulse and respiration remained normal; the operation was completed, and a few minutes after she suddenly revived and felt perfectly well.

In each of the above cases the strength of the solution employed was 1 to 10 of 1 per cent., and not over sixty minims were used in either instance.

3. Sequestrotomy of tibia; man thirty-four years of age.

During the course of the operation pulse and respiration increased; the patient became excited and talked at random, but complained of no pain. After being placed in bed and the administration of strychnine he became rational, but could remember nothing of the operative procedure.

In this case, analgesia was accomplished by the regional method, Schleich solution No. 2, by infiltration; about two drachms were used in exposing the sciatic and the anterior crural nerves, then about ten minims of cocaine, 1 per cent., into the nerves.

In a series of over eighty cases, in which Eucaine B was employed as the local anæsthetic, no such symptoms made themselves manifest.

But it must be remembered that such symptoms as those presented in the above cases are not necessarily due to the toxic action of the cocaine, for, instead, they may be due entirely to nervous or psychic phenomena. And even deaths which have been accredited to general or local anæsthesia might be accounted for in the same manner.

Death from fright is neither an unknown nor an impossible circumstance, as such cases are on record, and had these accidents been preceded or accompanied by an anæsthetic, the death would have been held against the particular agent employed.

Reclus has done 7000 operations under local cocaine anæsthesia, and in all these has never met with a death that could be in any way attributed to it.

He places great importance upon the following rules.

1. Never use a stronger solution than 5 per cent. or 1 per cent.

2. Always have the patient recline during the administration of the anæsthetic, and not get up for half an hour after the operation is completed.

3. Always have the patient eat or drink something before arising.

Reclus has carefully searched the literature, and has been unable to find a single published case of mishap in which these rules had been followed or even approximated.

Another objection to the use of cocaine is the claim that it cannot be rendered sterile, as heat will cause it to become decomposed.

But Cushing, in speaking of the Schleich solution, says, "Contrary to the experience of many, we have found that one or two sterilizations fail to diminish its efficiency."

Riley has emphasized the necessity of a proper selection of the cocaine crystals, and then, regarding the sterilization of it, says, "One hour's heating of the dried cocaine at this temperature, 302° to 320° F., does not impair its efficiency, notwithstanding many statements in the books to the contrary."

And Matas says, "Repeated experience has taught me that cocaine solutions can be heated up to the boiling point for a number of times without losing their efficiency."

These disadvantages, toxicity and the inability to sterilize, have been the chief reasons why cocaine has been superseded by the use of other preparations in local analgesia. Though Cushing and others find in eucaine an agent less satisfactory than cocaine.

Eucaine A, the first product to bear the name, was of but little or no improvement over cocaine; but Eucaine B, or the improved preparation, has for its most characteristic and advantageous features the following: (*a*) Non-toxicity, the fatal dose being so large, between .4 to .5 gramme (6 to 7.5 grains) per kilogram (2.5 pounds) of body weight, that there is practically no liability of such a lethal dose being injected in the course of an ordinary local anæsthesia. (*b*) It may be sterilized by heat without the loss of any of its anæsthetizing properties. (*c*) It will not deteriorate or decompose with keeping, (*d*) and, it is claimed, will not increase the tendency to hæmorrhage to any marked degree; that vasomotor paralysis and secondary hæmorrhage will occur less frequently than after the use of cocaine. These points have been the most influential in placing Eucaine B as the local anæsthetic of choice, and its use is being rapidly increased.

Local anæsthesia has made most wonderful and marvellous strides in development and expansion since its introduction.

At first cocaine was employed in high percentages and alone, for the more comparatively insignificant minor operations of surgery. Since then its use has been extended into all the branches of general surgery and the specialties, but few of the major as well as the minor operations have not at some time been performed under local anæsthesia.

In 1885 its use was practically confined to ophthalmology, and in surgery to the anæsthetization of the skin, previous to the lancing of a boil.

In 1902 we read of a case of "Cæsarean Section under Local Anæsthesia."

The interval in time being filled by its gradual adoption, dependent upon improvements that were being constantly made, and its being utilized in almost all of the possible intervening operations.

Local anæsthesia, or analgesia, may be divided into three subdivisions:

1. Direct anæsthesia.
2. Infiltration anæsthesia.
3. Regional anæsthesia.

1. By direct anæsthesia is understood the injection of the anæsthetic substance directly into the tissues, subcutaneously, at the site of the proposed incision, where it acts directly, chemically, upon the nerve endings of the region. Also in the application of the anæsthetic substance to the mucous membrane that is to be interfered with surgically, as in the eye, nose, pharynx, urethra, or rectum.

The strength of the solution to be applied to the mucous membrane will vary from 2 per cent. to 10 per cent., and for the injection under the skin, 5 per cent. or 1 per cent. are as strong as are usually employed, but in the early days of its use 10 per cent. and even 20 per cent. solutions were employed. But the evils associated with these strong solutions soon lead to the adoption of the smaller percentages, and these in turn have been superseded, to a very large extent, by the so-called "Infiltration Anæsthesia."

2. Infiltration anæsthesia constitutes a marked improve-

ment in local analgesia, and was presented by Schleich in 1899, in his "Schmertzlose Operation." Although Halsted, in this country, and others on the continent had independently noted the physical phenomena which serves as a basis of this particular form of anæsthesia, *i.e.*, the intradermal instead of the hypodermal injection of the solution, and the utilization of very dilute solutions of cocaine or its substitutes, or even plain water, depending for the analgesic effect, to a large extent, upon the physical conditions, such as the œdema, stasis or ischæmia in the blood-vessels, pressure upon the terminal nerve filaments, and a low temperature, rather than to the direct chemical action of the analgesic drug or drugs.

The different Schleich solutions are composed as follows:

	No. 1.	No. 2.	No. 3.
Cocaine muriatis	gr. iv. (0.2)	gr. ii. (0.1)	gr. $\frac{1}{5}$ (0.01)
Morphine muriatis	gr. ½ (0.025)	gr. ½ (0.025)	gr. $\frac{1}{10}$ (0.005)
Sodii chloridi	gr. iv. (0.2)	gr. iv. (0.2)	gr. iv. (0.2)
Aquæ destillatæ	dr. iv. (120.0)	dr. iv. (120.0)	dr. iv. (120.0)

From the above formulæ there are many variations and modifications, but they are the foundation or the basis for the others. The second solution is the one ordinarily employed; the first is reserved for those cases in which there is an acute inflammation and hypersensitiveness; the third is recommended where a large amount of the solution will be required.

Constriction of the part, if possible, or the chilling by the low temperature of the injected fluid, or the external application of cold is recommended, because a retardation of the circulation in the infiltrated area will augment the action of the injected drugs, and while prolonging the anæsthesia will at the same time diminish the dangers of over-absorption and the occurrence of intoxication; likewise allowing of the administration of a much smaller dose than would be necessary if these precautions were not followed out.

With the same results in mind, Braun, of Leipsic, earnestly advocates that adrenalin chloride be exhibited before or with the infiltration solution. And in a recent communication

emanating from the clinic of Bier, the administration of adrenalin, previous to the spinal anæsthesia, is recommended.

As a cardiac stimulant, adrenalin will also be indicated in overcoming the depressing action of cocaine or eucaine.

Another reason for incorporating adrenalin chloride in the infiltration solution will be because of its hæmostatic action. In the proportion of from 1 to 5000 to 1 to 20,000, it will be found to decrease the capillary hæmorrhage to practically nothing.

The tissues for about two inches surrounding the injected area become blanched. The vessels remain contracted for a couple of hours, and so prevent postoperative congestion and pain. From a very large experience, it has been found in no way to favor the occurrence of secondary hæmorrhage.

With the above solutions and their modifications the skin can be most readily and satisfactorily rendered non-sensitive, the panniculus cannot be œdematized, and, therefore, according to Schleich, it cannot be anæsthetized by infiltration. But, as a rule, it will never be found necessary to attempt to anæsthetize the panniculus after the skin has been rendered analgesic. The deeper underlying structures can be infiltrated similarly to the skin, and with the same solution.

The muscle, fascia, aponeurosis, and even the periosteum, may all in turn be rendered completely non-sensitive by this method, and, owing to the weakness of the solution, the small percentage of cocaine, the danger of symptoms arising from the over-absorption of the drug is very slight.

The temperament of the patient, especially the psychic element, the manner of introducing the solution, the personal equation of the operator, and, above all, an accurate knowledge of the minute nervous anatomy of the region, are of great importance in determining the success or failure of the method.

In order to render the first prick of the syringe needle unnoticeable, ethyl chloride has been recommended, but a drop of pure carbolic acid from the end of a probe will at the same time sterilize and anæsthetize the point.

For large or massive infiltrations, Matas has devised a

special apparatus with the object of dispensing with the troublesome and time-consuming filling and refilling of the ordinary syringe.

Similar automatic syringes have been devised in Germany.

The administration of morphine sulphate, one-quarter of a grain, hypodermically, fifteen or thirty minutes before the injection of the anæsthetic, has become almost a routine measure; it is indicated in all major or long cases, and especially in nervous or timid patients it will be found to act as a most satisfactory soothing and quieting adjuvant to the local anæsthesia. The morphine is also of value in this manner, as it is a true antidote to cocaine.

The chief contraindication, outside of idiosyncrasy, will be found in its constipating action upon the bowel.

In some instances, because of the moral effect upon the patient, or because of a desire to use the smallest possible amount of general anæsthetic, on account of various conditions, the use of morphine and then cocaine may in turn be followed by the inhalation of chloroform. This morphine-cocaine-chloroform anæsthesia will be found to be very advantageous in reducing the amount of general anæsthesia necessary in a given case; and, again, it may be deemed advisable to administer a small amount of inhalatory anæsthetic, even though the field of operation may be proven analgesic, for its moral or quieting effect upon an extremely nervous individual.

It has been generally acccepted that the analgesic action of this infiltration was due, not so much to the direct chemical action of the anæsthetic agents employed as to the physical action of the solution itself.

As a matter of fact, Schleich claims that thorough œdematization of the skin with a 2 per cent. salt solution, which is of a lower temperature than the body, is all that is essential in infiltration anæsthesia.

The analgesic drugs that are added in very small percentage are merely for the purpose of overcoming a hypersensitiveness of pathological tissue.

Simple œdema, caused by plain or sterile water, will cause

an anæsthesia, but a very short and painful one, and is known as the "Anæsthesia Dolorosa," of Liebreich.

An œdema caused by the injection of .2 per cent. salt solution is practically painless; a solution, in order to cause little or no pain, must be isotonic, *i.e.,* having the same specific gravity, and the same freezing point as that of the normal tissues into which it is injected. More concentrated solutions will absorb water from the cells, and so give rise to pain. Less concentrated solutions cause the cells to swell, and in this way cause pain.

But this theory as to the exclusively physical action of the infiltration anæsthetic will be found to be severely attacked by Marchinowski, who claims, after experimentation and clinical observation, that the local anæsthesia by infiltration or simple injection is always and only due to the poisonous action of the drugs upon the terminal nerve filaments.

He further claims that swelling, pressure, irritation, and differences of osmotic pressure and of temperature disturb and interfere with the anæsthetic, and in no way aid in the production of anæsthesia, nor in its maintenance when once established.

The fact that anæsthesia can be produced by the pure and simple œdema caused by the injection of an isotonic solution has been demonstrated, but it is an anæsthesia impracticable in surgery, or, as Matas says, "My personal experience has convinced me that if the cocaine were excluded from them (Schleich's solution), they would cease to be of value as practical surgical anæsthetics."

The infiltration method, while eminently satisfactory in many cases, in others it is not sufficient; especially is this true in those cases involving an extensive dissection, or in which large nerve-trunks are to be severed. In these major operations, a more satisfactory anæsthesia is accomplished by means of what has been termed regional or regionary anæsthesia.

3. Regional anæsthesia consists of the injection of a comparatively strong, 1 per cent. to 3 per cent., solution of the anæsthetic agent into the sensory nerve that supplies the field

of operation, usually at a convenient point between the central nervous system and the site of operative interference, although in some cases the nerve or nerves may be injected when they are exposed in the operative wound.

A combination of the infiltration and the regional methods is usually employed, the former for the skin and the superficial parts, during the dissection and isolation of the nerves; and then the latter, by the direct injection into the nerve.

At times it may be inconvenient to expose the nerve by dissection, and then an injection into the perineural tissues will, as a rule, be found ample and sufficient. The injection should be made into the region of the nerve that is to be interfered with, and the nerve surrounded by what Matas terms an "Anæsthetic Atmosphere."

This acts in the same manner as an intraneural injection, prevents the passage of impulses, and results the same as if the nerve was divided at this point, the so-called "Blocking," which allows of the carrying out of operative procedures distal to the injection without the occurrence of pain.

Another point regarding this "Blocking," as shown in the splendid works of Crile and of Cushing on the subject of shock, is that by so blocking the nerve, centripetal impulses are prevented from reaching the centre, and in this way remove one of the most important, if not the chief, causes of shock.

Under general anæsthesia, the afferent impulse of pain is not received, or at least not recognized, by the centre; but other afferent impulses caused by various factors, such as mechanical, thermal, electrical, or other stimuli, which act deleteriously upon the circulatory, respiratory, vasomotor, and sympathetic systems, are not interfered with, and these, on reaching the centre, give rise to the symptom complex known as "shock."

In local regional anæsthesia there exists what Crile has termed a "Physiological Amputation," and such impulses are absolutely blocked, and, in consequence, shock diminished or prevented. This procedure, the blocking of large nerves, should be carried out in amputations, even though a general anæsthetic is administered.

The application of infiltration and regional anæsthesia has been enlarged very rapidly during the last few years, and is assuming a position of importance in the subjects of anæsthesia and of surgery.

The experience upon which this article is based includes over 100 operations for various pathological conditions, in which local anæsthesia, as above considered, was administered.

The operations were such as:

The incision and drainage of abscesses in different parts of the body, including ischiorectal, peri-urethral, and appendiceal.

The removal of ganglion, epitheliomata, lipomata, bullets, and other foreign bodies, to enable the proper cleansing of crushed fingers and toes.

Amputation of fingers and toes and tenorrhaphy.

Sequestrotomy of tibia.

Freshening the edges of fractured tibia, for non-union.

Removal of internal saphenous vein, for varicose ulcer.

Plastic operations on nose and face.

Removal of tubercular glands of the neck and goitre.

Resection of rib for empyema.

Radical cure of inguinal and ventral hernia.

Radical cure of hydrocele, varicocele, and phimosis.

Appendicectomy, Talma operation, suprapubic cystotomy, exploratory laparotomy.

Internal urethrotomy, removal of hæmorrhoids, and urethral caruncle.

In all of these various operations, in only one instance was there anything like an unsatisfactory result, the others being most satisfactory in their final outcome.

In one of the eight inguinal hernias operated upon by the aid of local anæsthesia, there occurred a sloughing of the skin of the margin of the wound.

A brief history of the case is as follows:

Mr. S., American, miner, seventy-eight years of age. Came to St. Vincent's Hospital for treatment of a varicose ulcer of the

right leg. He has not been in good health for a number of years; was injured in a mine, and had his foot severely crushed, since then he has been very "nervous."

In the course of the examination, his nervousness was found to be a paralysis agitans; his arteries were markedly sclerotic, with an enlarged liver and a chronic bronchitis.

Besides the varicose ulcer, there was discovered a large oblique inguinal hernia on the left side, and on the right side a direct inguinal hernia.

The left side, he informed us, came down suddenly while lifting a trunk about two years previous; about six months afterwards he noticed a swelling in the inguinal region of the right side. He had been wearing an improperly fitting truss for about a year, but the swelling was gradually becoming larger.

As it would be necessary to confine him to bed in the treatment of the ulcer, it was suggested that he have the hernias operated upon at the same time; but he expressed himself as being afraid that he was too old to stand the chloroform.

When it was explained that it would not be necessary for him to go under the influence of either chloroform or ether, he was very anxious that the operations should be performed.

The operations were usual in every particular, and the technique of the anæsthesia the same as in the other cases. Schleich solution No. 2 was employed.

Ferguson operation on the left side, and on the right side a plastic procedure, as the conditions warranted.

The deeper sutures were of formaldehyde gut, and, instead of inserting skin sutures, on account of the very poor condition of the blood-vessels, the skin wound was united by means of strips of adhesive plaster. The patient complained of no pain whatever during or after the operation, and the blood-pressure during the operation did not vary over five millimetres, according to the Riva-Rocci sphygmanometer.

On the third day he complained of slight pain on the left side; there was no temperature, but the dressings were changed, and the following conditions disclosed.

The wound of the right side normal. The wound of the left side had made no effort at repair; the deeper structures seemed to be united perfectly, but the skin was separated by a gap at the incision. The external margin of the wound was thickened,

dark, and gangrenous in appearance for a distance of from a quarter to half an inch from the cut edge.

The internal margin of the wound was similar in appearance, but the swelling did not extend over a quarter of an inch from the incision. Wet dressings were applied, and the next day these necrotic portions were removed with scissors, and the wound packed with gauze.

At no time were the sutures of the external oblique muscle visible.

At no time was there any interruption in the primary union of the wound on the right side.

It would seem, *a priori,* that this sloughing was caused by the infiltration, in that the temporary ischæmia had remained as a permanent one. But, on the other hand, it is difficult to explain in what manner, or as a result of what, this unusual termination occurred. Had superficial stitches been employed, the explanation would have been very naturally that they had been tied too tightly.

The same solution, in about the same amounts, was used on both sides; the two operations were of practically the same duration and severity; and, while the resistance of the patient was considerably below par, there is no convincing reason for the belief that there was less resistance on one side than on the other. The presence of infective matter in the solution will, of course, be considered as a possible cause, but the isolation of the trouble to one side will make such an explanation doubtful.

This accident the writer wishes to be placed on record as an accompaniment of local anæsthesia, in this particular instance; as to whether it should be correctly classed as a result or not, will be shown by further experience and wider observation.

Bad as this circumstance was, still, it is to the credit of local anæsthesia that this individual could be operated upon and relieved from the danger and the trouble of his hernias.

For a general anæsthetic was most certainly contraindicated in such a case as this, especially so for the undertaking

of an operation which would not be directly a life and death measure.*

The above list of operations which have been included in the writer's experience, by no means constitute a catalogue of the conditions in which this mode of anæsthesia has been successfully utilized.

As stated above, it has been employed, with more or less success, in almost every operation in the list of surgical possibilities.

As showing the important position that local anæsthesia has assumed, attention may be called to the fact that Mikulicz has classified operations into

1. Operations in which a local anæsthetic is positively indicated.

2. Operations in which a general anæsthetic is positively indicated.

3. Borderline operations.

Under 1 are placed extirpation of small non-malignant tumors, tracheotomy, gastrostomy, strangulated hernia, etc.

Under 2, extensive operations on the head, majority of laparotomies, removal of large malignant growths, such as carcinoma of the breast.

Under 3, gastro-intestinal operations, goitre resections, herniotomies.

Various objections have been raised against the use of local anæsthesia; but it would seem, after a comparative study of the two methods, that the chief objections are to be found on the side of general anæsthesia in those cases allowing of local anæsthesia.

The danger of sepsis has been considered serious by some, but with a careful and ordinary aseptic and antiseptic technique it has been practically eliminated.

The occurrence of shock and nervous prostration has been

* Three months after operation, Mr. S. presented himself for examination, and at that time no evidence of recurrence was apparent.

The patient states that on the tenth day after his discharge from the hospital, he rode on horseback from Aspen to Leadville, fifty-four miles.

considered as one of the terminations to be expected after the performance of an extensive operation under such an anæsthesia.

Deaver has said, "Local anæsthesia, as used by Kocher, in goitre operations cannot become popular in this country, where people are more susceptible to shock . . .; the fright of so severe an operation as thyroidectomy would result in greater shock."

On the other hand, Huntington, in speaking of Basedow's disease, says, "The facility and thoroughness with which local anæsthesia can be accomplished is almost universally recognized. . . . Cocaine, or one of its analogous compounds, has supplanted chloroform and ether, and their great value is manifest in this over all other applications of these drugs."

He also advocates the cocainization of the nerve-trunks that supply the region of the gland, and reports cases in which the cervical (superficial) was blocked, as is done, for example, in hernia operations.

This is a most important innovation, because the nerves in and about the glottis are capable of exerting inhibitory influences upon the cardiac and respiratory centres. Manipulation or other stimuli may excite this inhibitory function, but it would seem that by this blocking such evil effects may be prevented. By the introduction of a minimal amount of the solution, the entire operative area may be rendered analgesic, and at the same time shock may be prevented.

Curtis says, "I have employed local cocaine anæsthesia in thyroidectomies for ordinary goitre with excellent results, but hitherto have hesitated to use it in operating upon patients with exophthalmic goitre, because I feared the effect upon the heart. But hereafter I shall make a trial of it in these cases too."

Witherspoon, in speaking of the same condition, says, "A general anæsthetic is dangerous, and those who operate under general anæsthesia are going to obtain poor results."

These quotations, in a way, show the status of opinion regarding local anæsthesia in simple and even exophthalmic

goitre; similar expressions of opinion could be quoted in connection with most of the other operations in which this method of producing anæsthesia has been employed.

The fear of the patient that he is going to be hurt has been presented as an objection. This fear may be present at the beginning of the operation, but it is soon dispelled if the anæsthesia is carried out properly, and replaced by a commensurate sense of relief in the discovery that he is not being hurt.

The occurrence of actual sickening pain when the viscera are being handled is a serious drawback to the method in laparotomies where visceral adhesions are to be separated.

The visceral peritoneum, under normal circumstances, is non-sensitive when compared with the parietal; but in making traction upon the mesentery, or attachments of other intra-abdominal organs, a dull dragging ache will make itself manifest that will, in many cases, demand a general anæsthetic.

In one laparotomy, in the writer's experience, local anæsthesia did very well until an attempt was made to break down some of the adhesions in the pelvis. This could not be done without a general anæsthetic; but as it was a so-called morphine-eucaine-chloroform anæsthesia, the amount of the latter was very small as to what it would have been without either of the other agents. The presence of intra-abdominal adhesions that demand separation is in itself a contraindication to the farther use of local anæsthesia.

The advantages to be derived from the employment of local anæsthesia are many, the first and foremost being:

1. Removal of the danger of death on the table. Others which may be mentioned are:

2. Avoidance of the after effects of general anæsthesia on the heart, liver, kidney, and lung; but postoperative pneumonia seems to occur about as frequently after one anæsthesia as the other.

3. No period of postoperative nausea, vomiting, or unconsciousness.

4. No danger of patient being drowned in fæcal vomitus.

5. Patient, being conscious, is able to assist the operator in various ways.

6. Reducing by one the number of assistants; although it will be found to be convenient to have an assistant at the head of the patient to encourage and reassure him, and to be ready to administer a whiff or two of chloroform, if necessary.

Da Costa has said, "Valuable as the method is, it should be used as an adjuvant to, rather than a supplanter of, general anæsthesia."

This statement we would attempt to enlarge upon by remodelling, as follows; Valuable as the method is, it should be used as an adjuvant to, when not possible as a supplanter of, general anæsthesia.

That there are many cases in which local anæsthesia is markedly contraindicated, there is no rational doubt. And, on the other hand, that general anæsthesia is many times employed unnecessarily is a fact.

We do not urge the promiscuous use of local anæsthesia, but we do urge an appreciation of the fact that local anæsthesia is safe and practicable, and better than general anæsthesia in many cases where the latter is commonly employed. And in attempting to impress this fact, we can do no better than to quote from Von Mikulicz, who has said,—

"The question of to-day is *not* which is the safer anæsthetic, chloroform or ether, but in what cases can local anæsthesia be substituted for anæsthesia by inhalation."