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LOCAL AND SPINAL ANÆSTHESIA*

By ROLAND T. DE HELLEBRANTH, M.D.(New Jersey, U.S.A.),

MR. CHAIRMAN, LADIES AND GENTLEMEN :

I wish to express my deepest gratitude for giving me the opportunity to address such a distinguished audience here to-night, and in return I shall do my utmost to deserve this great honour, and your kind hospitality. However, I am a little bit worried about my English, which I know is rather poor, and I cannot forget what a fellow-passenger of mine said, that in his opinion it must be very hard to deliver a lecture in a foreign language, whereupon I informed him that it is fairly easy to give the lecture, but it is much harder for the audience to understand it. Consequently, ladies and gentlemen, to-night's greater burden rests upon your shoulders.

I have had the pleasant opportunity of visiting your country and your splendidly equipped hospitals several times. As a matter of fact, I never consider a trip to Europe complete unless I get a few glimpses of London, and so I am fully

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aware of the fact that if there is any country in the world where inhalation anæsthesia is administered in the most perfect way, then it is England. Yet you all must admit that there are occasions in a surgeon's life when he hesitates to put his patient to sleep.

Just two days before I sailed for England, a six year old boy was brought into the hospital with a perforated appendix and heavy congestion in his chest. I was certain that by putting him under ether his chest condition would develop into pneumonia. Or let us take the case of a very obese woman suffering from cancer of the breast, and requiring an extensive, long-drawn-out operation, after which for probably many hours she won't be conscious enough to take deep breaths, and thus be exposed to post-operative pulmonary complications. Or again, let us take the case of a diabetic requiring amputation of one leg, in whom a rapid increase in the blood sugar would result from the administration of a general anæsthetic. Or finally, let us take the case of an emaciated man suffering from pyloric obstruction requiring a prolonged operation.

Don't you think, gentlemen, that in all these and similar cases, we should welcome an anæsthesia which will prevent all these afore-mentioned complications? Far be it from me to advocate that spinal or local anæsthesia be used for every patient, in every case, and at any time, but by carefully selecting the cases, they undoubtedly have their advantages.

I may sound very conceited if I inform you, that I shall only give a brief report of my own experiences, consisting of a little over eight hundred operations performed under local anæsthesia, and a little over two hundred operations performed under spinal anæsthesia. I don't want to burden you with the description of different techniques, with the history and theory of spinal and local anæsthesia, and with the discussion of the different drugs, because you may ask, as I have often done after finishing a text-book—which anæsthesia, which drug, which technique, was found by the author to be the best and most advisable one? I shall also refrain from burdening you with statistics, because they usually serve one theory and try to prove the skillfulness of one surgeon. Nor shall I burden you with the description of anæsthesia of rare and very delicate operations, which are not frequently done, like the extirpation of the Gasserian ganglion, etc.

It may be mentioned in my favour that all these operations were done in my private hospital, on private patients, who probably need more delicate treatment than the free clinic patients, on whom a little more operating is usually done with less consideration for their sensitiveness.

A.—Local Anæsthesia.

Preparation Employed.

The drug I recommend to be used for the administration of local anæsthesia is **Novocain**, of which I generally use a one-half per cent. solution, adding fifteen drops of adrenalin to each one hundred cubic centimetres of novocain solution. This solution is generally used for local anæsthesia where a larger amount of solution is necessary. However, for the block or conduction anæsthesia, a two per cent. novocain is advisable but naturally in a smaller amount.

Apparatus Required.

The instrumentarium is a most simple one—two ten c.c. syringes, and a few very small, fine, and sharp needles, with which the anæsthesia is started, injecting just a few drops of novocain-adrenalin solution intradermally, building the so-called wheals at such distances from each other that they may be connected subcutaneously by using the longer needles—about three inches long.

Anæsthesia of Head.

The sensory nerves of the head, coming chiefly from the trigeminus and from the spinal nerves as the occipitalis major and minor, auricularis magnus and cutaneus colli, emerge and pass through the fascia and skin on a line approximately drawn from the occipital protuberance to the eyebrow, encircling the skull.

Wherever we want to operate, it is sufficient to inject around the operative field beneath the fascia, thus interrupting the sensory nerves. Subperiosteal injection is entirely unnecessary. The subcutaneous or subfascial injection renders all sensitive parts insensitive. The bone is not sensitive, nor is the brain tissue. The dura is only sensitive towards the base of the skull.

I would recommend this anæsthesia for repair work on the skull after various injuries, for brain puncture, decompressive trepanation, for the removal of benign and malignant growths of the skull, for tying the arteria meningeae media, or for the removal of a hematoma in the temporal region.

Anæsthesia of the temporal region is done in the following manner: about 0.5 c.c. of a one-half per cent. novocain-adrenalin solution is injected in the form of several wheals, surrounding the prospective operation area. These wheals should not be further from each other than five centimetres and should be placed so that on account of the convexity of the skull they can be easily connected by a subfascial injection of the novocain solution. It is advisable to infiltrate the lowest line more thoroughly, because one goes through the temporal muscle. After the skull is opened, as I said before, the dura will be found slightly sensitive in the lower segments only.

Often we receive patients with rather extensive injuries to the skull in a comatose state, which eliminates the necessity of any kind of anæsthesia, yet for the repair of those injuries I would still suggest the use of the one per cent. novocain-suprarenin solution on account of its splendid blood-stilling effect. Only the large blood vessels will bleed, but sufficiently to indicate their location so that they can be readily clamped and ligated. The small vessels, on the other hand, will never bleed so profusely, even after the solution's hæmosthatic effect has worn off, as to cause severe hæmorrhages or annoying hæmatomata.

Anæsthesia for Tonsillectomy.

I don't know if tonsillectomies belong to the resort of general surgeons, but since it is so in the United States, I shall briefly describe the anæsthesia for the removal of the tonsils. The throat is carefully and most thoroughly swabbed with an equal solution of adrenalin and ten per cent. cocain hydrochloride, preceded by the hypodermic injection of one milligram of atropine sulphate, which saves the patient from the constant desire to swallow his saliva. The posterior wall of the pharynx, both pillars of the fauces, and the surface of the tongue, are rendered insensitive by means of a long, curved needle, the half per cent. novocain-adrenalin

solution being injected in such a manner that first the needle is inserted above the tonsil where the two pillars meet, then the other injection is made in the middle part of the anterior pillar. Into each point, half of one c.c. of the above-mentioned novocain solution is injected, and after refilling the syringe, the needle is directed behind the tonsil. Here, by pulling the piston out of the syringe we find whether or not the needle point is in a blood vessel, in which case the needle has, of course, to be retracted. But if no blood appears in the syringe, 2 c.c. of the novocain solution are injected, and it will give every surgeon great pleasure to see how nicely the tonsils protrude from their hiding places, being elevated by the injected solution.

After the same process has been repeated on the left side, we wait for five minutes, and then the operation can proceed.

Anæsthesia for Thyroidectomy.

The soft structures of the front of the neck are supplied by the anterior branches of the second, third and fourth cervical nerves, whose terminal branches, the auricularis magnus, cutaneus colli, and supraclavicular, come to the surface at the posterior edge of the sternocleidomastoideus muscle. A subcutaneous and subfascial injection along this site is practically of no value, because it only renders the skin of the neck insensitive. Complete anæsthesia of the region supplied by the specified nerves is only obtained by anæsthetizing the nerves as they leave the spinal column.

The best way to do this is to draw a line on the side of the neck behind the sternocleidomastoideus muscle. This indicates the transverse processes of the cervical vertebræ. This line begins above, immediately behind the tip of the mastoid process and passes slightly backwards from the posterior edge of the sternocleidomastoideus muscle forming an acute angle with it. The transverse process of the atlas is felt under the mastoid process and lower the transverse process of the sixth cervical vertebra is felt as a rule. So the first injection should be made at the level of the angle of the lower jaw and the second at the level of the prominence of the thyroid cartilage. From these two points the needle is directed to the transverse processes of the cervical vertebræ, which must be felt with the point of the needle, and all tissue layers between the process and the skin are thoroughly infiltrated with the one half per cent. novocain-adrenalin solution. This is done on both sides of the neck, after which the skin around the enlarged thyroid gland should be infiltrated with a small amount of novocain solution.

Anæsthesia for Operations on the Upper Extremities.

This is not considered to be purely local anæsthesia, but rather a block or conduction anæsthesia. However, I shall discuss it here because it is one of the easiest ways of anæsthetizing the upper extremities in cases of hugh phlegmones of the hand, or fractures, dislocations, and any other operations which are to be performed on the arm or hand.

In this case, we aim to block the brachial plexus and this can be reached in the easiest and most secure way above the clavicle. The first rib crosses the clavicle at about its middle part, and here is the point where we want to reach the brachial nerves. They are running above the first rib laterally from the subclavian artery. The landmarks here are the anterior scalenus muscle, the clavicle and the omohyoides muscle. Reaching therein with our left index above the middle of the clavicle, the pulsation of the subclavian artery is felt. Slightly laterally from this point is

placed a wheal of novocain, infiltrating the skin. Then a fine, long needle is inserted here, directing its point toward the spinous process of the second or third dorsal vertebra. At the distance of half an inch the nerve is reached with the needle, of which fact we can easily be convinced if we explain to the patient that he will have paræsthetic sensations in his arm and fingers on the corresponding side. These are similar to an electric shock, and most patients can stand them without the slightest movement. As soon as they report this paræsthesia, a syringe is attached to the needle and 10 c.c. of a two per cent. novocain solution are injected. Another 10 c.c. of the same solution are injected without retracting the needle, in the neighbouring soft tissues.

The first rib will prevent us from entering the pleural cavity, and by pulling the piston out, we can be convinced whether we got into the subclavian artery or not. If we should obtain blood, meaning that we have injured the blood vessels, all we have to do is to retract the syringe and not to fear that any harm or damage has been done.

The anæsthesia usually doesn't occur for twelve to fifteen minutes, after which we find that not only is the whole upper extremity rendered insensitive, but even the axillary nerve is paralysed, and remains so for from one and a half to three hours.

This anæsthesia can be obtained in about 95 per cent. of all cases.

Anæsthesia for Radical Operations of the Breast.

Here we must apply the combination of local and continuation anæsthesia, by which complete insensitiveness may be obtained, so much so that not only the removal of the entire pectoral muscles can be performed without the aid of inhalation anæsthesia, but also the axillary glands as well. This anæsthesia is especially suitable for the most extensive plastic operations which are necessary in the majority of cases of very obese women.

The anæsthesia is started by blocking the spinal nerves after they have left the intervertebral foramina. The best place for this purpose is between two ribs at the distance of about four centimetres from the midline. The patient is placed upon the table in a position similar to that which is adopted for a lumbar puncture serving diagnostic purposes. She is sitting up straight, an assistant or nurse holds her with head bent down, and possibly motionless. A long strip is painted on the skin with iodine, parallel with the line of the spinous processes, and at a distance of about four centimetres from the same. Then the spinous process of the first dorsal vertebra is located, which, remembering the prominence of the seventh cervical vertebra, can easily be done.

The first injection is made at the level of the spinous process of the first dorsal vertebra, and the point of the needle is carefully shifted downwards until it is pronouncedly felt that the lower edge of the first rib is not only reached, but passed, after which the needle is inserted about half of one centimetre deeper, and at this level five c.c. of the one per cent. novocain solution introduced.

It is much easier to continue the anæsthesia if this needle is left in place, and another needle is inserted in a similar way below the first one at the level of the spinous process of the second dorsal vertebra. After the same amount of novocain solution has been injected here, the first needle is removed and inserted below the second one at the level of the spinous process of the third dorsal vertebra, and so we continue the injections until we reach the eleventh dorsal vertebra.

I really think the description of this anæsthesia takes longer than the actual operation, but it blocks all the intercostal nerves, and we can proceed to the application of local anæsthesia on the chest.

Here first of all we must block the supraclavicular nerves by injecting half of one per cent. solution alongside the clavicle, starting from the acromion. It can be done here directly on the collar bone, or slightly above or slightly below it. Then we proceed by injecting the same solution in the midline of the sternal bone, following the edge of the lower ribs. In a semicircular line this injection is continued until we reach the spinal column in the back. In order to have perfect freedom in removing the glandular metastases, it is advisable to anæsthetize also the brachial plexus.

The amount of novocain used is not much. It is the time that matters, but if we consider how freely we can work on a very obese woman, where inhalation anæsthesia is most harmful, then we can truthfully say that the fatigue and time consumed in obtaining a perfect anæsthesia are well worth while.

Anæsthesia for Operations on the Upper Abdomen.

The operations I should suggest to be performed under local anæsthesia above the navel would be, gastrostomy, simple gastroenterostomy, and exploratory laparotomy. For pylorus resection and more complicated manœuvres, local anæsthesia can only be employed in combination with nitrous oxide anæsthesia. When it is necessary to break up adhesions, or to introduce walling-off gauzes, or to carry out extensive exploration, it is advisable to employ general anæsthesia; but if we don't have to be prepared for extensive manipulations, or the explorations and application of walling-off gauzes, and the organs on which we want to operate, for instance the stomach and part of the small intestines in a case of gastroenterostomy, are isolated and lifted out of the abdomen, the general anæsthesia can be stopped and the operation performed without further difficulty.

It is interesting that the mesentery is more sensitive than the omentum, consequently the ligation of the first should be preceded by novocain.

I think patients suffering with pylorus-occlusion are usually so weak and have such a low resistance that we should be glad to see that they don't suffer from the anæsthesia at all. One of my patients who had an old pyloric obstruction was on the table for three hours and twelve minutes. I performed a gastrectomy with gastroenterostomy, and encountered great difficulty on account of the ulcer that was penetrating into the pancreas and the innumerable adhesions around the stomach and duodenum. It was interesting to record, however, that the patient, an Italian, was deeply absorbed during the entire operation in a conversation with one of my nurses who was standing at his head, and who happened to speak Italian, having been in Italy during the war. The operation was performed without the use of any inhalant anæsthetic agents, but before the wound was closed the skin edges had to be reinjected with novocain because the sensitiveness had already returned.

For that operation 140 c.c. of a half per cent. novocain solution were used, and the only time he experienced pain was when the duodenum was mobilized. By the time he left the operating table, he was in the same condition so far as temperature, pulse and blood pressure were concerned, as he was when he entered the operating room, consequently, no hypodermoclysis was needed. He also made an uneventful recovery, and never vomited after the operation.

For the afore-mentioned operations, we select the following methods of local anæsthesia: for gastrostomy we just infiltrate the skin, the subcutaneous cellular tissue, and the fascia in the line of the incision. We don't find any sensitive organs in this place if we perform it under the left rib. For this anæsthesia, usually 35 c.c. to 40 c.c. of one half per cent. novocain-adrenalin solution are required. For other operations on the stomach, the anæsthesia is as follows: six wheals are applied, one to be placed at the xyphoid process, two on each side at the distance of about three inches, and one under the navel. After the skin is opened and we reach the præperitoneal fatty tissue, about 5 c.c. of novocain are injected into it. Then, when a small opening is made in the peritoneum, we push our left index finger underneath, and inject another few cubic centimetres of novocain intraperitoneally. In this way the abdomen can be opened without causing the slightest pain, and the afore-mentioned operations can be performed.

Anæsthesia for Appendicectomy.

For the removal of an inflamed appendix, the ileocœcal region can be comfortably anæsthetized, but only if we operate for chronic appendicitis, or for an acute appendicitis which is the first moderately severe attack. It is absolutely not advisable to use local anæsthesia in cases of abscess, or some other severe appendical complication.

In this case, the ileocœcal region is infiltrated from five points, the line of infiltration lying near the iliac spine being the most important one. Here, too, we not only infiltrate the skin, subcutaneous cellular tissue, but inject also novocain under the aponeurosis. Opening the peritoneum will hardly cause any sensation to the patient, but traction on the cœcum will do so, consequently it has to be handled very carefully, and it is advisable to infiltrate with a few cubic centimetres of novocain the mesenterium, too. In those cases where local anæsthesia is not advisable, I suggest the use of spinal anæsthesia, which I shall discuss a little later.

Anæsthesia in Operations for Hernia, Hidden Testicle, Hydrocele and Varicocele, Castration, and Operations on the Spermatic Cord, Testis and Epididymis.

A few drops of novocain solution are injected at four points, the first of which is about two inches from the anterior superior iliac spine, the second close above the root of the penis, the third and fourth in such a manner that, with the two previous ones, they should build the third and fourth angles of a rhomboid shaped area, which encloses the inguinal canal. Then a longer needle is inserted in the first wheal in such a manner that its point is directed downwards in a practically vertical direction, and pushed in almost until the iliac bone is reached. Carefully pulling it out, but always pushing it back again towards the concavity of the iliac bone, about 20 c.c. novocain are injected, so that all the nerve fibres of the ilio-inguinal and iliohypogastric regions are reached. As it is known, the iliohypogastric nerve runs parallel with the twelfth intercostal nerve in front of the musculus quadratus lumborum, then turns outward to lie between the musculus obliquus abdominis. At the middle third of the iliac crest the nerve gives off one branch, called the ramus cutaneus lateralis, but its main branch, called the ramus cutaneus anterior, reaches the subcutaneous region just above the external inguinal ring. These fibres supply the lower part of the abdominal skin. The ilio-inguinal nerve is weaker; it also runs parallel with the afore-mentioned

nerves, between the afore-mentioned two abdominal muscles, and its anterior end-branch runs through the inguinal channel and supplies with nerves the skin of the mons pubis. The same nerve gives off smaller branches to the skin of the scrotum in men and to the labia majora in women, respectively. By infiltrating the area just described, these two nerves are practically blocked and as a consequence a large quadrant of the lower abdomen is rendered insensitive. When nearing the surface, the needle is not removed, but led towards the other wheals, practically connecting them with a subcutaneous stream of novocain.

However, we are not satisfied with this process, so while pulling the needle backward, and injecting the novocain, the needle is always pushed back again and again in a more vertical direction, so that the subcutaneous fatty tissue is also infiltrated. After this is done, the needle is inserted under the spermatic cord, and there about 10 c.c. of the novocain injected. Even in regions where no vital blood vessels are placed by nature it is more advisable to inject the novocain while pulling the needle back.

If the patient happens to be a very stout or very large person, and there is no sufficiently long needle at our disposal, we make more than one wheal between the iliac spine and the root of the penis.

In case we want to be especially nice to our patients, even the hernial sac can be anæsthetized in the course of the operation, by infiltrating the peritoneum with a few cubic centimetres of novocain. I once witnessed the operation performed on a doctor for right inguinal hernia. He agreed to have local anæsthesia, and everything went well. He was quiet, and no movement of his facial muscles betrayed the slightest pain. However, shortly before the operation was completed he yelled out so loud that we all were afraid of an instantaneous recurrence of his rupture. "Give me gas, ether or chloroform," he shouted, "or hit me on the head, but do something, because I can't stand it. I never knew that the peritoneum could be so sensitive." Of course his request was not fulfilled, instead he was informed that he had mixed up his peritoneum with his skin, because by the time he yelled, the surgeon was ready to apply the skin-clips, the hernial sac having been long attended to, even his appendix having been removed. His pain was purely mental, because he remembered that the peritoneum is sensitive and he was certain that its handling would hurt.

Anæsthesia for Hæmorrhoidectomy.

The solution to be used is a one half per cent. novocain-adrenalin and the amount is about 95 c.c. In cases of hæmorrhoids, fissures and fistulas, local anæsthesia is ideal. It gives complete relaxation and complete anæsthesia.

After the patient is placed in the usual lithotomy position and the operative area painted with five per cent. tincture of iodine solution, a few drops of novocain solution are injected at the distance of about one third of an inch from the anus in four opposite points, making four small wheals. Then, with a long needle, all those four points are connected with subcutaneously injected novocain, leaving the needle in situ at the last point. Then the left index finger, covered with vaseline, is inserted in the rectum, after which the needle is pushed in practically parallel with the inserted finger. With very little practice, we can reach with the needle point the loose connective tissue which separates the rectal mucous membrane from the internal sphincter muscle, and by injecting the novocain into that space, the swelling of which can be easily felt with the inserted finger, the mucous membrane

is evenly elevated and separated from the sphincter muscle, thus rendering especially the hæmorrhoid operation of Whitehead very simple, and especially safe for the sphincter muscle.

After this separation is carried out from both sides, the rectal muscles are so relaxed that they can be easily stretched. If the patient doesn't complain of any pain, we know that we have rendered one of the most sensitive places insensitive, because, as is known, the stretching of the rectum is often used as a measure in reviving fainting or moribund patients. I strongly advise the stretching of the internal sphincter muscle in any kind of rectal operation. It will keep the rectal muscles from a constant twitching and contraction which is usually the cause of a patient's postoperative sufferings and nervousness following rectal operations. After the muscle is stretched, the operation can proceed in the usual manner.

B.—Spinal Anæsthesia.

As it is known, the spinal cord extends to the level of the lower border of the first—or, in children, the third—lumbar vertebra, where it ends in the filum terminale. The spinal cord and the cauda equina are invested by their pia, arachnoid and dura as far down as the middle of the sacral canal. The cerebrospinal fluid communicates with the general ventricular cavity of the brain through the foramen of Magendie, in the roof of the fourth ventricle, and comes in contact not only with the spinal roots, but also with the roots of several of the cranial nerves, namely the oculomotorius, trochlearis, abducent and optic nerves.

Aim of Spinal Anæsthesia.

The aim in spinal anæsthesia is to penetrate the subdural cavity and bathe the spinal nerve roots in the analgesic solution. Anæsthesia of the posterior or sensory roots is most marked because their position favours ready contact with the anæsthetic fluid, and because, as is well known, sensory fibres are more susceptible to novocain than motor fibres. Anæsthesia first appears in the perineal region, then in the legs, the lower abdomen, and finally at the costal margin. Its duration can be prolonged, if necessary, by employing larger doses of the anæsthetic agent.

If I remember well, spinal anæsthesia was completely condemned in England not so many years ago, but it must have been at the time when the combination of proper drugs and the proper combination of different drugs respectively were not well known, and left the same dangerous impression in surgeons' minds that the use of pure cocain did until its derivatives and different substitutes were discovered.

Advantages of Spinal Anæsthesia.

The indisputable advantages of spinal anæsthesia are, first of all, that it is applicable in the case of such major operations as cannot be performed under local anæsthesia, and when the patient's general condition will not permit the use of inhalation anæsthesia. It is most suitable in cases where the patients suffer from any kind of cardiac or renal disorders, or hepatic malfunctions. In tubercular patients it is especially useful; in confinement cases, where some obstetric operation has to be performed—to mention the most important one, Cæsarian section. In these cases, where we are most anxious to relieve the patient's thoracic organs from any kind of strain caused by an eventually prolonged labour (and we know the danger of any kind of inhalation anæsthesia to the affected lungs) spinal anæsthesia is the anæsthesia of choice. In diabetic patients where we have to

amputate the limb, and we know that under ether the blood sugar would rise, spinal anæsthesia is also an excellent anæsthesia. Furthermore, it has the great advantage that it gives complete relaxation of the abdominal muscles and at the same time contracts the intestines and relaxes the sphincter muscle, the consequence of which will be that if we operate on patients suffering from distended bowels we soon find that by the time the abdominal wall is opened most of the accumulated gas has been evacuated, thus greatly facilitating the operation and rendering unnecessary the extensive use of walling-off gauzes.

Spinal Anæsthesia suitable for all Ages.

There is practically no age limit in the use of spinal anæsthesia, because it can be used with just as much safety in a middle-aged man, in an eighty-year old man for prostatectomy and in a two-year old child for acute appendicitis. As a matter of fact, children bear the blood-pressure-lowering effect of the spinocain much better, due to the elasticity and contractibility of their vascular system.

Contraindications of Spinal Anæsthesia.

There are a few contraindications, the most important one of which is, of course, a very low blood pressure, which renders the use of spinal anæsthesia dangerous. I also do not recommend its use in cases of a spinal disease, and especially in cases of meningitis or neurosyphilis. The most dreaded danger so far has been the sudden drop in blood pressure, but this can be avoided by the injection of epinephrine prior to the injection of the spinocain. This reaches the blood vessels in the periphery much quicker than the blood-pressure-lowering effect of the spinocain would, and makes it possible to use spinocain even if the blood pressure is not over 100 mm. systolic and 65 mm. diastolic.

Preparation Employed.

The drug I mostly recommend is **Spinocain**, which contains novocain and strychnin sulphate in a special solvent consisting of alcohol (14.5 per cent.) and sterile water, with the addition of an amylo-prolamin combination. This substance, which is responsible for its viscosity, is harmless. The amount of novocain in each 2 c.c. ampoule of spinocain is 200 mg., and in each 3 c.c. ampoule, 300 mg. strychnin sulphate is present in the strength of 2.2 mg. in each ampoule.

Dosage.

The dosage is simple. Up to six years of age I would recommend one c.c. for abdominal operations. Up to the age of seventeen, two c.c. should be used, and above seventeen, 3 c.c. For operations performed on the lower abdomen, two-thirds of this dose should be used, and for operations on the lower limbs or the perineum, one-half of the above dose is advisable.

Apparatus Required.

The instrumentarium is another simple accessory in this type of anæsthesia, consisting of glass syringes and long 22 or 23 gauge needles, with a very short bevel. The short bevel is of advantage because when penetrating the dura there is no danger of having part of the opening of the needle outside the dura. If the bevel were too long, part of the injected solution would get into the extradural space, and thus not give a satisfactory anæsthesia. The best needles are those of rustless steel with a snugly-fitting stylet.

Technique of Injection.

The technique is not complicated, although it is slightly more difficult than the ordinary spinal puncture, because it must invariably be performed with the patient lying on his left or right side. According to Dr. Pitkin, spinocain should *never* be introduced into the spinal canal with the patient in the sitting posture. The best way to have the patient in an appropriate position is to instruct him to draw up his knees and put his chin on his chest—"trying to look at his own navel". An attendant stands on the other side of the table, facing the patient, and placing one hand on the patient's neck, the other under the patient's knees in an attempt to draw together these two extreme points as near as possible. Care must be taken that the line connecting the patient's shoulders and the line connecting the iliac crests should be perfectly vertical and parallel to each other. Placing a small pillow under the patient's waistline often helps to straighten out the line of his spinous processes and avoid any twisting.

After the patient is well steadied in this kitten-like posture, the iliac crests are located and connected by a line drawn with tincture of iodine. This line will cross the spinal column just above the third intervertebral space. The novocain-ephedrine mixture is deposited here in the form of a subcutaneous wheal, and the spinal needle inserted through the wheal. The needle—which should not be of a larger gauge than 22 or 23, is held in a ninety degree angle and pushed forward in this direction. After the interspinous ligament is pierced, the needle point reaches the dura, which can be felt by its distinct resistance, and which is penetrated with an almost audible, but characteristic, snap. The stylet is then withdrawn, and if the needle is in the proper place, spinal fluid will appear slowly dripping from the needle. No continuous flow or fast dripping should be expected on account of the needle's small calibre. If no spinal fluid appears, the needle should be withdrawn, and not bent, trying to change its direction. It also should be immediately withdrawn if blood appears through the canula, unless it clears up after the first few drops and is followed by clear spinal fluid.

Having the needle in the correct position, and obtaining a few drops of clear spinal fluid, the syringe containing the spinocain solution is attached and the solution slowly injected. If high anæsthesia is desired, the solution should be mixed with the spinal fluid, first drawing a few cubic centimetres of the latter into the syringe and then reinjected. This process may be repeated several times. The more spinal fluid is withdrawn and added to the spinocain in the syringe, the higher will the anæsthesia extend. After the syringe is emptied, the needle is finally withdrawn. No cover over the site of the puncture is necessary.

The table is tilted, but only placed in the correct position after the desired height of anæsthesia is obtained. If 3 c.c. of spinocain are used the table is placed in a ten degree Trendelenburg position for operations under the costal margin. In perineal operations or operations on the lower extremities, using 2 c.c. spinocain, the table is immediately put in a fifteen degree Trendelenburg position.

And now, ladies and gentlemen, that I am about to finish my words, I wish to add that I am fully aware of the large gaps which remain unfilled in my speech—unfilled especially from a scientific point of view, but I must repeat that my aim was to give a brief description of all the activities of a general surgeon's everyday life as far as local and spinal anæsthesia are concerned. I shall be too glad to answer any of your valued questions—provided they are within my limited knowledge, and if I have succeeded in awakening your interest in the matter sufficiently to ask questions, I shall be more than satisfied. I thank you.