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SPINAL ANESTHESIA IN OBSTETRICS AND GYNECOLOGY*

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IT IS said that all medical and surgical procedures must go through three stages of development. First, the optimistic stage, second, the pessimistic period, and third, the time of adjustment. This appears to be true of spinal anesthesia, perhaps more so than some of our other procedures. The stage of optimism may be easily accounted for, with the American people in particular, as they are always ready and grasping for something new, something spectacular. This overenthusiasm influenced many surgeons to take up spinal anesthesia without first familiarizing themselves with the technic. They often would not take the time or trouble to gain, even, a fair knowledge of the physiologic actions of the drugs.

In the early days of spinal anesthesia, one had to contend with more toxic drugs, it is true, than are now available but much of the pessimism was due, to a great extent, to the bad results reported by men who knew little or nothing about the procedure and would not take the time to familiarize themselves with its intricate value. The time of readjustment, if such has arrived, has been brought about by the earnest endeavor and research of those men who really strived to solve its mysteries.

Ephedrine, has possibly, contributed as much to the safety of spinal anesthesia as did adrenalin to the success of local anesthesia. The regulation of the specific gravity of the solution injected, either light or heavy, is almost as old as the method itself, as well as the attempts at producing viscous solutions with various tenacious substances, such as acacia, gum arabic, etc., in an endeavor to control the anesthetic solution in the dural sac. Amyloprolamin, a refined soluble gliadin,

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extracted from the mucilaginous content of wheat starch, produces a viscid solution that will prevent diffusion of the anesthetic solution with the spinal fluid until such time as the anesthetic agent has become fixed or absorbed. It reduces the toxicity of the anesthetic drug and places it under the control of the operator, permitting him to anesthetize as few or, as many groups of spinal nerves as is considered necessary to produce anesthesia of the desired field.

By limiting the contact of the solution to only those strands of the cauda equina, that form the sacral nerves, we were able to produce intradurally, sacral anesthesia in over 99 per cent of our cases, within three minutes. This form of anesthesia anesthetizes the cervix, vagina, vulva, perineum, and anal sphincter. The limited contact of the anesthetic to the extreme tip of the dura, causes no anesthesia of the hypogastric plexus, therefore normal uterine contractions are not inhibited. The result is, a painless childbirth.

INDICATIONS

I do not desire to advocate this form of anesthesia as the best or as one of choice, but we are often confronted with complications of pregnancy, where any form of inhalation anesthesia is absolutely contraindicated, therefore, it would seem worth while, at least to have a working knowledge of controllable spinal anesthesia to compete with certain complications. Tuberculosis, either arrested, chronic, or active, is often associated with various lung complications after inhalation anesthesia and the dormant, or arrested cases, are often converted into active lesions.

A woman suffering with acute or chronic bronchitis, should not be subjected to the possibility of a fatal pneumonia by giving her any form of inhalation anesthesia.

Patients suffering with asthma or emphysema are offered almost instant relief with controllable spinal anesthesia. This may be due, in part, to the ephedrin. Asthmatics cannot tolerate inhalation anesthesia.

Cardiacs with broken compensation are relieved at once. The cyanosis that accompanies each labor pain is relieved, and the patient is able to breathe with ease and if apnea is present, they are able to resume a reclining position comfortably within three or four minutes.

The toxemias of pregnancy are not affected by its use. There is no suppression. Elimination is not affected and dehydration is not produced by vomiting or aggravated by withholding of fluids.

Acidosis, which invariably accompanies the toxemias, is frequently relieved or greatly lessened. It is never increased. Acetone and diacetic acid disappears from the urine rapidly. The carbon dioxide content of the blood is not altered.

Nephritics, without eclamptic symptoms, are not subjected to the hazards of inhalation anesthesia.

Diabetics, a severe complication at best, has been shown by Joslin to respond better to spinal than any other form of anesthesia.

It has less effect on patients suffering with exophthalmic goiter or toxic adenoma, than does inhalation anesthesia.

The anemias of pregnancy are not affected by its use, as there is less hemorrhage at the time of delivery, no dehydration, or change in the blood chemistry.

Shock, caused by prolonged or tedious labors, may be carried through successfully with the free, but judicious use of ephedrin. The degree of shock is never increased after the administration of the anesthetic and oftentimes, improves materially.

The rigid spasmodic or cartilaginous cervix may be quickly and easily dilated manually. Light inhalation anesthesia, has little or no effect on this condition.

The extreme relaxation of the soft parts, even in a primipara, permits of the application of forceps with greater ease and the extraction of the child with less effort. The cooperation of the conscious mother and the normal uterine contractions, assist materially in the delivery. There is less trauma to the child and fewer lacerations.

In breech presentations the fate of the child is better, broken arms and legs are less frequent and delivery is performed with less effort.

In a case of prolonged labor, with the measurements of the mother and fetal parts normal, a rest period may be offered by mechanically expanding the solution from 4 to 6 c.c. This will cause uterine contractions to cease for two to three hours, when the pains are resumed, the mother is rested and able to help to a greater advantage.

Bandl's ring does not respond to inhalation anesthesia, unless carried to a dangerous stage and then, only with ether. Nitrous oxide or ethylene will have little or no effect in relieving the spasmodic condition. Spinal anesthesia if carried higher in the canal will relieve the contraction at once.

When versions are contemplated, the anesthetic should be expanded to 6 c.c., by mixing with spinal fluid, as this will abolish the tetanic contractions. There is no shock to the mother during the manipulations. She will laugh with you, as she has no discomfort.

Pituitrin may be used without harm, if given after the anesthetic, providing of course, obstetric judgment is used. It would seem to have some advantages over sacral or caudal anesthesia due to its quicker action, three minutes, as well as its certainty. There is no fifteen to twenty minute delay or 25 per cent of failures.

It has advantages over ordinary spinal anesthesia, in that, it does not affect normal uterine contractions, unless so desired by the operator. There is no vascular relaxation, nausea, vomiting, pallor, or cold sweats. Opiates are not necessary, such as morphine and scopolamine.

Its advantage over inhalation anesthesia is that there is no effect

on the heart, lungs, kidneys, or other vital organs of the mother. Post-operative lung, intestinal or kidney complications are nil.

When narcotics are employed or any form of inhalation anesthesia is administered to a pregnant woman at term, unquestionably some of the toxins of the agents are absorbed by the child, producing cyanosis and oftentimes rendering resuscitation difficult. This form of anesthesia in no way affects the well-being of the child.

ADVANTAGES

It assures the cooperation of the mother throughout delivery. She is able to change her position if desired, to bear down and aid in delivery without painful sensations.

It may be given to patients suffering with any of the complications of pregnancy without aggravating the condition.

Hypertension is not affected. Hypotension may be regulated by the use of ephedrin or by ephedrin and epinephrin combined. Our lowest case had a reading of 74/40, at the end of delivery, 120/68.

The absence of dehydration and suppression is a distinct advantage in toxemias and eclamptics.

There is no shock or postpartum reaction. Severe or prolonged cases are carried through with little or no change.

It increases the patient's comfort during and after delivery.

Vomiting during and after delivery is a rare occurrence.

Postpartum hemorrhages are less frequent. The uterus contracts firmly and quickly when it is emptied.

The cervix and perineum are protected to a greater extent from trauma and lacerations. The amount of relaxation and elasticity of these parts when anesthetized is amazing. Cystoceles are less apt to be a postpartum complication because the sphincters of the bladder are anesthetized and it, therefore, spontaneously empties itself.

Vaginal cesarean section may be obviated, as the cervix readily dilates, or it may be dilated manually with ease.

The mortality and morbidity of obstetric cases are reduced, because shock to the mother or postpartum anesthetic complications do not occur. The child is offered greater protection, because there is less trauma in forcible deliveries as a result of the relaxation of the soft parts, and because there is no absorption of toxins from narcotics or inhalation anesthetics.

Last but not least the obstetrician may be his own anesthetist, a distinct advantage in isolated practices, small hospitals without interns, or emergency night work.

TECHNIC

When local, conduction or spinal anesthesia is used, the paramount issue at all times is never to hurt the patient in any way at any time. A patient once hurt may lose confidence in the method and in the doc-

tor. A confidence once lost may be very hard to regain and many times constitutes the direct cause of unsuccessful anesthetics. A patient who is immediately subjected to one painful manipulation becomes overapprehensive of every following procedure. In spinal anesthesia with novocaine, tactile sensation is not abolished. All the more reason why every precaution should be taken and the technic employed with such finesse, that spinal anesthesia may be administered without producing any pain. With an entirely satisfactory anesthesia, the patient should be at ease, comfortable, and cheerful throughout delivery.

To perform the lumbar puncture, raise the head of the delivery table from 15 to 20 degrees. This degree of elevation is hard to judge but is readily measured by the use of the tiltometer. The patient is then in a slightly reverse Trendelenburg position and should be kept so throughout the course of delivery. If for any reason this is impossible she may be placed nearly flat, but not until after the anesthesia has become fixed, namely from twelve to fifteen minutes. If an adjustable delivery table is not available, pillows may be employed to secure a similar position.

The patient should be turned on her side, preferably the right. The knees should be flexed upon the abdomen, the head bent forward, so that the chin rests on the chest, and the back bowed out. The shoulders and hips should be in a vertical line. If the shoulders are tilted and the hips remain vertical or if the hips are tilted and the shoulders perpendicular, a corkscrew spine will be produced and may present difficulty at the time of puncture. A scaphoid back should be avoided as this causes the spinous processes of the vertebrae to override and makes puncture difficult and painful. If the physician is unfamiliar with the technic of this position, the patient may be permitted to sit on the edge of the delivery table with the feet hanging over the side, the body bent forward, the elbows resting on the knees and the back bowed outward. She may be permitted to remain in this position for from ten to twelve minutes until anesthesia becomes fixed or may immediately be placed in a semireclining position with the head of the table elevated as already described. However in the sitting position the patient's comfort and ease is disturbed. Never permit the patient to lie entirely flat or in a Trendelenburg position (22 degrees) when the heavy solution is used, as there is danger that the solution may ascend high in the canal and produce a drop in blood pressure, nausea, vomiting, and headaches.

The skin from the eighth dorsal to the lower part of the sacrum is painted over an area 5 or 6 inches wide with a 3 per cent tincture of iodine. If for any reason iodine is contraindicated, 5 per cent mercurochrome may be substituted. The logical site to introduce the spinal puncture needle for this particular form of anesthesia would be the lumbosacral interspace so as to introduce the anesthetic solution directly at the site of contact, but unfortunately in a number of cases we have found that the dural sac terminates above this interspace, therefore the fourth interspace is selected as the site of puncture. This may easily be determined by palpating the spinous processes along an imaginary line drawn between the crests of the ilia. When the interspace between the fourth and fifth lumbar vertebrae has been determined, it may be marked by firm pressure with the thumb nail of the gloved hand. At this site a cutaneous wheal is raised with 0.65 c.c. solution of novocaine, 0.013; ephedrine, 0.5; and normal saline q.s., 1.3.

A fine 25 or 27 gauge hypodermic needle is used. The needle is not withdrawn but is carried directly into the interspinous ligament and the other 0.65 c.c. of the solution injected as the needle advances. One should endeavor to inject the solution a little faster than the needle proceeds, so that the needle is introduced into

a freshly anesthetized area. To avoid the unpleasantness of having to dig out a broken needle it is advisable to have the needle equipped with a safety guard.

Spinal puncture is made through the center of the wheal, raised with the novocaine ephedrine solution with a fine 22 gauge lumbar puncture needle. The needle should have a short bevel of 45 degrees. The rear part of the bevel is rounded in such a manner that it has no cutting surface, while the reverse side of the point is ground so as to produce a spear point. When this needle pierces the dura it cuts a miniature trapdoor which is closed by the intradural pressure when the needle is withdrawn. The spear point of the tip permits easy penetration of the skin and tissues. For many reasons, rustless steel needles are superior to nickeloid or nickel-plated ones. In every case, the stylet should be removed and the needle bent into a semicircle before it is sterilized. This testing may prevent the unpleasantness of removing a broken needle from the interspinal ligament.

Avoid using a needle of large caliber, such as the old Bier 15 to 17 gauge needle, which will not only cause unnecessary pain, but will traumatize the tissues and often produce postanesthetic backache. A large needle may produce intradural hemorrhage or it may injure or cut the cauda and permit seepage of spinal fluid into the extradural tissues, because of the large hole left in the dura. Long, tapered needles produce bleeding more frequently at the time of puncture. With their use anesthesia is frequently unsatisfactory, because a part of the taper is within the dura and the remainder outside, or a part of the taper is within a vein and the remainder in the dural sac. Should only a part of the taper be within the dura, some of the solution is deposited extradurally. Anesthesia will be unsatisfactory or incomplete. Should part of the taper be within a vein when the solution is injected, convulsions may ensue. With a short tapered needle, these undesirable complications rarely occur. When the puncture is made through the interspinous ligament, care should be taken not to deviate to the right or left. The puncture should be at right angles to the long axis of the spine. Never attempt a puncture between the laminae. Avoid inserting the needle in an upward direction or at an acute angle to the spine. The veins about the cord are large and numerous but may be avoided and not penetrated if the spinal puncture is made in the manner described. Unnecessary bleeding will surely be produced should the puncture be attempted between the laminae with the needle tilted, with a needle of large caliber, or with a long tapered point.

When the dura is punctured there is a slight snap, which is recognized after the first few punctures, and the needle advances with less resistance. If possible, avoid piercing the opposite side of the dura with the point of the needle, or coming in contact with the body of the vertebra, because this also will cause bleeding. With the assurance that the dura has been entered, the stylet is removed and spinal fluid should flow through the needle. If no spinal fluid appears, rotate the needle on its own axis. If there is still no spinal fluid, insert the needle deeper. If bony resistance is felt (the body of the vertebra), the needle has undoubtedly deviated to one side. It should be withdrawn to the skin surface and reinserted at a slightly different angle to the right or left as the case may be. Always have the stylet in place when making manipulations. Occasionally the first drop or two of spinal fluid will contain blood. If this clears the injection may be made. If not, the needle should be withdrawn and reintroduced. The injection of the anesthetic solution should never be made until clear spinal fluid flows through the needle, which is the only assurance that the point of the needle is within the dural sac. Unless the solution is injected into the subarachnoid space, anesthesia will not be satisfactory.

It is advisable to fill both hypodermic syringes with the respective solutions before the spinal puncture is started. The filled syringes and needles should be placed in a convenient position to the operator before the procedure is started.

Attach to the spinal puncture needle the syringe with the solution containing: novocaine, 0.2; gliadin solution, 0.13; strychnine sulphate, 0.0022; glucose, 0.065; and normal saline, q.s., 0.5. Aspirate one or two drops of spinal fluid to make sure that the needle has not been displaced, then slowly inject the contents of the syringe. Do not again aspirate or in any way attempt to mix the solution with the spinal fluid. Withdraw the needle and cover the puncture wound with collodion or a small square of adhesive plaster. Turn the patient on her back. Anesthesia will be complete as soon as the patient can be prepared and draped. This procedure limits the contact of the solution to the lower tip of the dural sac and causes anesthesia of the perineum only.

It is better to have a syringe with a secure locking device to insure a tight fit to the needle, thus preventing the possibility of injecting air into the dural sac or leakage at the connection. With a locking device on the syringe, the needle may be manipulated, if necessary, and if the patient moves there is little chance that the syringe will be disconnected from the needle, and some of the anesthetic solution lost. With the locking device employed, needles never become "jammed" and there is no leaking at the connection.

The semireclining or reverse Trendelenburg position of from 15 to 20 degrees should be maintained for one and one-half to two hours after injection so as to avoid the possibility of having the anesthetic ascend in the canal; also by retaining the anesthetic low in the dural sac, headaches will be greatly diminished. If for any reason anesthesia is desired higher on the body surface it can be obtained by mixing the solution with spinal fluid. This is done by aspirating and reinjecting 2, 4, or 6 c.c. of the spinal fluid. Four c.c., aspirated and reinjected, will produce anesthesia of the legs. Six c.c. will carry anesthesia to the umbilicus and 8 c.c. to the costal margin. For the higher anesthesia the viscid alcohol solution is preferable as this will permit the patient to be placed in a level or Trendelenburg position. The heavy solution should never be used when the head is to be lowered.

Preoperative narcotics are not necessary in this form of anesthesia. The relief of pain afforded the mother, allays all fear and apprehension. Morphine and scopolamine, if used, may possibly so affect the child that strenuous resuscitation methods will be necessary. The mother may remain in a dorsal recumbent position or may be placed in stirrups without affecting the limitation of the anesthesia provided the body is kept in a reverse Trendelenburg of from 15 to 20 degrees.

It is hoped that my intentions will not be misconstrued. I do not wish to imply that this is the ideal or only form of anesthesia to be employed in obstetrics. It is offered as being, simpler, quicker and more efficient than caudal and as a method of relieving pain, suffering, and misery in those unfortunate cases in which any form of inhalation anesthesia would be detrimental or fatal to the mother, child, or both.

(For discussion, see page 280.)

DR. GEORGE P. PITKIN read, by invitation, a paper entitled **Spinal Anesthesia in Obstetrics and Gynecology**. (For original article see page 165.)

DISCUSSION

DR. JOHN B. DEEVER said there were given over 4,000 spinal anesthetics in his clinic, of which spinoecaine was used in 443. There is no question of the superiority of this type of anesthesia in selected cases.

DR. WAYNE BABCOCK felt that Dr. Pitkin had perhaps done more in the last two years, than any other man in this country to popularize the method and attempted to bring almost micrometer precision in the use of spinal anesthesia so that it may be accurately limited to certain parts of the body. During pregnancy, however, the use of spinal anesthesia is not free from risk, especially in less skilled hands.

There are four things to be emphasized in giving the intradural injections: first, the force of the injection. If done with force the solution will go to a higher level than you anticipate. If you can keep it below the level of the second lumbar segment you will have no effect on the blood pressure, because only above the second lumbar segment lie the sympathetic fibers. If the anterior nerve roots are blocked above this point there will occur a fall in blood pressure which increases progressively until with the second thoracic segment, the cardiac contraction becomes slow and feeble, and the pulse may disappear from the wrist. If the external muscles which are used in respiration are deprived of function, the patient must live by the use of the diaphragm, but in advanced pregnancy the diaphragm is so splinted by the greatly enlarged uterus, that the patient, unless relieved by artificial respiration or the immediate emptying of the uterus, may die of asphyxia.

Spinoecaine solution diffuses rather slowly, but not as slowly as a similar solution with the viscid or starch element removed. The spinoecaine diffused more rapidly in five minutes, four hours, twelve hours, than did simple anesthetic solution containing a comparable content of alcohol. Dr. Babcock believed that perhaps Dr. Pitkin had been misled in thinking that the slow diffusion of his

solution was due to the starch, when it is really due to the alcohol. But after all, if there is not sufficient diffusion to block every nerve root supplying the operative field, the anesthesia will not be satisfactory. A degree of diffusibility is essential for dependable anesthesia.

A second important point is the bulk of solution injected. Higher and more widespread effects are produced by increasing the quantity of the fluid that is injected. A third point is the amount of cerebrospinal fluid withdrawn; if much is first withdrawn and the dura thereby decompressed, a higher analgesia will result. Fourth, the specific gravity of the solution in relation to the position in which the patient is placed greatly influences the location of the anesthetic, although not as much as the location of the interspace selected for the injection. If the drug is not in excess it will soon fix itself to the nerve elements, and after ten minutes the area of anesthesia can rarely be changed. No manipulation of the patient will then modify the effect, unless there is an excess of the spinal anesthetic or something which prevents the attachment of the drug to the nerve roots.

All four of these points should be considered whenever spinal anesthesia is given, and one may again recall Dr. Pitkin's precision in technic. But the large dose of procaine in heavy solution which he recommends in obstetric operations is not free from danger. Ninety-eight or 99 of such injections may have no serious complication, but in the hundredth a serious collapse and death may occur unless special precautions are taken. With an obstetric patient so often restless and thrashing around in bed there is a special hazard when an excess of the anesthetic is within the dura.

Dr. Babcock considered that spinal anesthesia should not be used except in a well-appointed hospital and with the presence of associates well trained in the methods of resuscitation. There are three things which are sheet anchors when the patient appears about to die from the intradural injection: first, adrenalin by vein or heart to stimulate the circulation (ephedrin is not dependable in the dire emergency); second, artificial respiration, if necessary, by mouth to mouth insufflation, and third, maintenance of the temperature of the body.