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Saddle block anesthesia in obstetrics

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SADDLE BLOCK ANESTHESIA IN OBSTETRICS

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TABLE OF CONTENTS

Introduction and History of Anesthesia and Analgesia in Obstetrics.....1

Saddle Block Anesthesia: Description of, Anatomic Considerations and Histopathologic Effects of Intradural Anesthetic Drugs........15

Contraindications to Saddle Block Anesthesia..........................19

Aim of Saddle Block Anesthesia..21

Correct Technique in Saddle Block Anesthesia..........................21

Purpose of Experiment with Saddle Block Anesthesia...................29

Material..29

Method..34

Results and Discussion..38

Brief Discussion of Complications in Saddle Block Anesthesia, and Treatment..45

Summary...47

Conclusions...48

Bibliography..53

INTRODUCTION AND HISTORY OF ANESTHESIA AND ANALGESIA IN OBSTETRICS

From Time Immemorial the pain of childbirth has been the lot of the female. There has been no other tribulation so singly anticipated, or so unerringly inescapable, as the pain during childbirth. Man has described the pain concomitant with childbirth rather well, but seemed actually to have had little to offer by way of relief to the lying-in woman. The Bible[1] alludes to the travail of childbirth, and in describing fear and pain can only compare the worst possible as that experienced by the woman in childbirth. Early efforts to relieve the pain of childbirth are recorded in early Chinese history, when opiates and soporific potions were used.[2] In Shakespeare's "Romeo and Juliet"[3] a gift given to Juliet by the Friar consisted of a distilled liquor whereof she should drink, and the pangs of childbirth would not be felt by her; she would only sleep "in this borrowed likeness of shrunk death".

The midwife in early times provided the chief obstetrical care given the parturient woman. Many midwives contrived to make childbirth as painless as possible by rendering the patient intoxicated with alcohol. Witches' brews had their place, but apparently were not generally accepted - women bore their children without analgesic aid, outside that kindly rendered available by Mother Nature.

Mans' cruelty to his fellows is a well known fact. His advent into this world, and the adverse conditions under which he made his entrance were in no wise minimized, but his bearer was subjected to hideous routines designed for the benefit of no one. These early civilizations devised a great many mechanical torture devices to "aid" in bringing on childbirth.[4] Some native tribes in the South Pacific bound their women to trees, hands tied overhead, and the child was delivered with the patient standing erect. This practice was not as bad as it sounds. But the Apache Indians suspended their women from a tree, with a rope under the armpits of the woman; then the strong braves of the tribe grasped the parturient above the fundus of the uterus and swung all their weight against it. Some Asiatic tribal women knelt while in labor, one or two assistants stood on her shoulders, while she tried to pull herself into a standing position by grasping a pole. Other techniques consisted of having men of great weight jump up and down with their feet upon the abdomen of a woman, in order to hasten childbirth. Surely, the woman could, in those days, consider herself a most mistreated individual ! These, and other more barbaric practices, made the lot of a woman in labor an unenviable one.

In time a more humane civilization evolved which was adverse to inflicting additional tortures on a human already in the throes of a most painful ordeal. The first tentative steps forward in the relief of pain were hesitant and uncertain. Mesmerism, as one of the first steps forward in the relief of pain, had its vogue. Franz A. Mesmer[5] was the originator of relief of pain by what has since become known as mesmerism, or a form of hypnotism. Mesmer was regarded by leading scientists and physicians as a quack, but he had his followers, those most susceptible to suggestion. Somnambulism was a development of mesmerism and smacked more of hypnotism, and had its advocates, but failed to relieve operative pain.

Chemists necessarily were the pioneers in the field of anesthetics, and their experiments in the field of chemistry and daring exploits deserve honorable mention. Priestly[6] discovered nitrous oxide in 1772. In 1795 Humphry Davy[7] was bold enough to inhale nitrous oxide gas, and instead of dying he experienced less disastrous sensations; indeed, he felt so cheerful he felt compelled to laugh. In 1800 Davy suggested that nitrous oxide gas might have possible anesthetic qualities. Michael Faraday[8] made the next contribution. He discovered ether, and described the state into which a person could be thrown by the imprudent inspiration of ether. Thus, Faraday suggested the anesthetic possibilities of ether. These suggestions were long in being taken at face value, as is the case with any new and unknown procedure. Henry Hill Hickman[9] of England is one of the heroic figures in the development of surgical anesthesia. He anesthetized animals with carbon dioxide gas and thus was one of the first to experiment on animals and prove that pain of surgical operation could be abolished by the inhalation of a gas. The importance of maintenance of a constant blood flow and the necessity of being prepared to meet and deal with circulatory collapse was recognized by him, and this as early as 1824.

In America, the use of ether and nitrous oxide gas was developing.

Stockman of New York, (according to Kleiman)[10] was one of the first to demonstrate the exhilarating effects of nitrous oxide. There then developed the use of ether and nitrous oxide for pleasurable purposes, and from this the uses of these gases for surgical purposes. These "laughing gas parties" and "ether frolics" became quite a vogue. William E. Clarke, (according to Lyman)[11] a young student of chemistry in Rochester, New York, entertained his companions with inhalations of ether. Because of these experiences he later administered ether from a towel to a young woman, and Dr. Elijah Pope extracted one of her teeth without pain.

A young physician, Crawford W. Long, (according to Bigelow)[12] entertained the idea of administering nitrous oxide gas to patients during operation to lessen pain. A friend of his, James M. Venable, had two small tumors on his neck. Venable had participated in "ether frolics", and was induced to inhale ether and to be operated upon while under its influence. The operation took place on March 30, 1842, without pain to Venable, and thus ether was used successfully in surgery for other than dental operations.

Doctor Horace Wells, (according to Colton)[13] on December 10, 1844, attended a public demonstration of "laughing gas" (nitrous oxide gas) and noted its analgesic properties, and reasoned that the gas could be used for painless dental operations. On December 11, 1844, one of Wells' own teeth was extracted while he was under the influence of nitrous oxide, and he could feel no pain. Wells was unsuccessful in convincing a class in surgery at Harvard Medical School of the anesthetic properties of his preparation, and so the advent of nitrous oxide in surgical anesthesia was delayed.

William Morton, a former partner and pupil of Horace Wells, had witnessed Wells' unsatisfactory demonstration at the Harvard Medical School, where he was a student. Morton, a dentist, used ether locally in the extraction of teeth preparatory to fitting his patients with artificial teeth. Morton noticed the numbing effects of ether when applied too freely on the gums, and the idea occurred to him that perhaps the whole system could be brought under the influence of ether. Doctor Charles A. Jackson, Morton's preceptor, encouraged Morton to use pure sulphuric ether on his patients, after Morton had successfully anesthetized various animals and had tried it once on himself. On September 30, 1846, Morton performed his first successful dental operation while the patient was under the effects of ether inhalation. Morton then demonstrated his "invention" before the staff of the Massachusetts General Hospital at the invitation of Doctor C. F. Heywood on October 16, 1846.[14]

Soon after the discovery and recognition of the possible uses of inhalation agents in the relief of pain it was tried in obstetrics by Doctor James Simpson of Edinburgh, England, on January 19, 1847.[15] The patient, a gravida II, para 0, was a lame women with a badly distorted pelvis. She was in her fourth day of labor, and making slow progress. She was given ether to inhale, and Doctor Simpson was able to perform a difficult version and extraction. In this procedure the patient was unconscious for a period of twenty minutes, a relatively long time, in those days. Simultaneously, in America, Doctor Crawford W. Long began using ether in his obstetrical practice. Ether was given to one patient, on April 7, 1847, anesthesie a la Reine, (during, or at the beginning of, each contraction), totaling five administrations of ether for a period extending over thirty minutes. The patient had been in labor 5½ hours, and contractions were present every 5 minutes. The patient did not lose consciousness, and labor was not retarded. In experimenting, Doctor Long suspended inhalation of the ether in order to check on the effective force of the contractions without the ether, but noticed no effects other than increased distress on the part of the patient. In this instance a true scientific attempt was made to observe cause and effect of ether on the progress of labor.[12]

Doctor James Simpson was not altogether satisfied with ether, and began a search for other anesthetic agents. He tried various gases, and finally chose chloroform, and immediately began to use it in his obstetric practice because it had a more rapid action than ether.[16] Simpson was shortly thereafter attacked and defamed by the Scottish Calvinists as a blasphemer, heretic and agent of the devil, and a program against him was carried out from the pulpit, to the effect that he was going against God in his endeavors to relieve the sufferings of women in childbirth. Simpson fought well and hard against these attacks for six years. On April 7, 1853, obstetrical analgesia by inhalation anesthetic agents received a resounding boost when Queen Victoria of England was delivered of Prince Leopold, her eithth child, by Sir James Clark.[17] His anesthetist, John Snow,[17] the first full time anesthetist, used chloroform, giving 15 minums at a time on a handkerchief. The anesthetic was given intermittently and inhalation analgesia was induced for the patient, who was not unconscious at any time. Queen Victoria thus became the first of royalty to receive the benefits of obstetrical anesthesia, and in doing so set an example the Scottish Calvinist clergy were not able to overcome. In 1857 Queen Victoria bore Princess Beatrice, again submitting to chloroform anesthesia. However, since the time of Simpson every advance in efforts to remove the pangs of childbirth has met with criticism from the medical profession, the laity, and more especially, the ecclesiastics.

Other agents for the relief of pain in childbirth were advanced. In 1880, Klikovich of Petrograd,[18] applied nitrous and oxygen inhalation anesthesia to 25 obstetrical cases. He noted that only three or four inhalations rendered the uterine contractions painless without clouding the consciousness of the laboring woman. In America, Doctor J. Clarence Webster, of Chicago, used nitrous oxide and oxygen in obstetric practice as early as 1909.[19] Scopolamine and morphine analgesia in obstetrics was first suggested by von Steinbüchel, of Gratz, in 1902 (according to Claye).[20] In 1914, William H. Knipe[21] first reported on the use of "twilight sleep" on a large number of cases in America. By 1918 the lay press had discovered "twilight sleep" and it became quite fashionable for women to have their babies by this method. Jaeger[22] was the first to use pantopon alone and in combination with scopolamine in obstetrics. The barbiturates soon entered the picture after Emil Fischer, of Berlin,[23] had synthesized barbital (veronal), the first of the barbiturates, in 1902. In 1921 the first report of the use of the barbiturates in childbirth was made by Hamblen and Hamlin, of Virginia.[24] In 1923, Cleisz, a Frenchman, used barbital and allylisopropyl barbituric acid in obstetric practice.[25] Many others reported on the use of a great variety of barbiturates in labor. Usually, the oral route was used in administering the barbiturates. Many combinations of drugs were tried, so many that this period of obstetrical analgesia is rightly called the "Battle of the Barbiturates".

The pantopon and scopolamine era followed the era of "twilight sleep". Gwathmey's[26] synergistic analgesia, consisting of nembutal with scopolamine, was soon followed by the pantopon, magnesium sulfate, and rectal ether series. Nikolas Iwanowitch Pirogoff,[27] the famous Russian surgeon, was the first to suggest the instillation of ether into the rectum for surgical anesthesia. Magendie advised Pirogoff that the ether might be a dangerous procedure and injure the rectal mucosa. Pirogoff therefore modified his intended method by vaporizing the ether. Others reported on the production of surgical anesthesia by this method. In 1913, Gwathmey[28] reported his experiments with ether and Carron oil, the misture being given as an enema and slowly introduced into the rectum. Later, Gwathmey used olive oil as the vehicle for the ether, and found that he secured some analgesic and anesthetic effect. His method was used on some 20,000 obstetrical cases and found to successfully relieve the pain of childbirth.[29] His method was later modified and supplemented by the addition of quinine to the ether-olive oil mixture for rectal instillation and by intramuscular injection of morphine and magnesium sulfate early in labor.

Avertin in minute quantities rectally was proposed in 1926 by Willstätter and Duisberg,[30] but was not popular because of its depressant effect. Paraldehyde has had some use in obstetrics, but its depressing effect on the vital mechanisms of the fetus caused it to be abandoned.

The search for new and better methods of obstetrical anesthesia was neverending. The anatomic approach to the control of pain in childbirth was investigated about the time that obstetric amnesia was being introduced. There were, however, the necessary pioneers in this other approach to anesthesia. In 1885, J. Leonard Corning[31] of New York, experimented with the possibilities of spinal anesthesia. He worked with dogs, attempting to inject solutions of hydrochloride of cocaine into the space situated between the spinous processes of two of the inferior dorsal vertebrae. He said he secured epidural anesthesia, although there are those who insist that Corning secured spinal and not epidural anesthesia. If Corning did not secure spinal anesthesia, he at lease secured regional anesthesia. In 1891 Quincke,[32] and Doctor Essex Wynter[33] of England, independently, discovered spinal puncture as a diagnostic procedure. Thus, another hitherto inviolate area of mans' anatomy was invaded, with no great disastrous results.

August Bier,[34] of Greifswald, Germany, in 1898, produced true spinal anesthesia in man experimentally, using a solution of cocaine which he injected into the spinal canal. Bier, in 1899, performed the first spinal anesthesia in man for surgical purposes. Later in the same year Matas[35] also produced successful spinal anesthesia in a Negro patient, this being the first report of spinal anesthesia in the United States.

In the field of obstetrics, Stoeckel,[36] of Marburg, Germany, suggested utilizing another approach to the anatomic relief of pain in childbirth. Utilizing the discovery of Cathelin[37] and Sicard[38] of Paris, that cocaine solutions deposited in the peridural space by the approach of the sacral hiatus blocked the painful impulses from the pelvic organs during labor and delivery, as the afferent fibers entered the dura mater, Stoeckel applied this knowledge to obstetrics, and thus the first attempt to relieve the pain of labor by the anatomic approach was made. In 1900 Kreis[39] reported the first use of spinal anesthesia in obstetrics. About 1923 reports of the successful use of caudal anesthesia began to appear in American literature, and was used quite extensively. Cleland,[40] Hopp[41] and Baptisti[42] first used more than one caudal injection during a single labor. Cooke[43] had used spinal anesthesia in many surgical procedures, and was impressed by the analgesia obtained in the perineal region. He reasoned that this type of anesthesia could be used in childbirth. On March 9, 1918, he delivered his first obstetrical case with spinal anesthesia, in thirty-five minutes, including a low forceps delivery and the placing of sutures. He recommended the method highly in an article published in 1923. Pitkin and McCormack[44] adapted, in 1928, a method for controlling the pain of childbirth, which they claimed to be the first instance of caudal anesthesia, at least in America. They termed their method "controllable spinal anesthesia in obstetrics", and reported their findings with great enthusiasm, describing their technique in anesthetizing the sacral nerves and limiting the anesthesia to the perineum, such anesthesia being distributed in such a fashion as to cause them to call it a "saddle" anesthesia.

Cosgrove,[45] in 1931, reported on the use of nupercaine subdurally in obstetrics, and apparently was the first experimentor to use this anesthetic and compare it with procaine (novocaine), a drug then in wide usage as a local and regional anesthetic. In 1940, Hingson and Edwards[46] began the use of sacral caudal block, and designed continuous caudal analgesia, first applied to obstetrics in 1942. Adriani and Roman-Vega[47] modified Pitkin and McCormacks' technique of "saddle" anesthesia, which abolished uterine pain as well as perineal pain, and called it "saddle block" anesthesia. Adriani[48] also suggested changes in Pitkin and McCormacks' technique, in 1946. Others,[49,50,51,52] began to use "saddle block" anesthesia and made reports on its use in obstetrics.

Over the years there have been many techniques designed to relieve pain during childbirth.[53] Chloroform analgesia and anesthesia was first given to a woman in labor by Simpson.[16] This type of analgesia and anesthesia is still used, especially in home deliveries and by older practitioners. This has been called "anesthesia a la Reine" because it was given to Queen Victoria of England at the beginning of each contraction. Chloroform is a potentially dangerous anesthetic, and the operator must know the proper technique of its administration during labor. Its use is best suited for the terminal stages of labor.

Ether in obstetrics was first instituted by Simpson,[15] in 1846. The usual method of producing analgesia is by the open-drop technique, and is given intermittently, at the beginning and during each contraction, with the patient being further anesthetized should cervical or vaginal lacerations occur, or episiotomy be performed.

Divinyl ether was introduced into obstetrics by Wesley Bourne,[54] usually administered by the open-drop method and the closed system. This agent is not used extensively today, but may have value in multiparous patients in terminal labor because of the rapidity of its action.

Nitrous oxide, ethylene and cyclopropane have been popular as agents of pain relief in obstetrics. Nitrous oxide has been used considerably longer than either of the other two agents. Nitrous oxide can be used during the first stage as well as during the terminal stages of labor. Ethylene is highly explosive, and therefore not used extensively today. Cyclopropane is used quite extensively in some sections of the country as an analgesic during the terminal stages of labor, but its potentcy and explosiveness causes it to be avoided by most obstetricians.

Then, there were the techniques for semi-narcosis and twilight sleep with scopolamine. These techniques were popular in the nineteen tens and twenties, and were used during the early stages of labor. There were various methods of administering the drug, usually in combination with morphine or pantopon, or demerol, or with the barbiturates. There was a high rate of "blue babies" requiring resuscitation, with morphine; pantopon was more successful, not having the depressing effect on the fetus as did morphine, and achieved a more ideal type of twilight sleep; demerol was more successful than the barbiturates in having less depressing effect on the fetus. These methods required skill in their usage, constant observation on the part of the attending physician, and were a great advancement, by and far, in analgesia in childbirth. Heroin[55] was tried, and found capable of producing a high degree of analgesia in a short time. However, its usage in the United States was negligible because of its unavailability due to the narcotic laws.

Rectal anesthesia was first studied by Gwathmey during the was years of 1914-17, and he applied his knowledge thus acquired to a study of the effect of ether-olive oil rectal instillations in obstetrics. This method produced a particularly good analgesia in home deliveries, but was abandoned in large measure because of a relatively high fetal mortality attributed to it.[28]

Intravenous anesthesia in obstetrics has never enjoyed great popularity, probably because of better methods. Sodium pentothal was the agent used, usually in the terminal stages of labor. Because of climactic conditions, this method was, and is, used in South America in preference to ether, which volatizes too rapidly, and chloroform, which is too depressing to the fetus.[56]

Continuous caudal analgesia enjoyed a tremendous popularity, and at first seemed to be the ideal obstetrical analgesic. The method appeared to be extremely promising, but the procedure in itself is a formidable undertaking, a great deal of pains-taking skill is necessary, the chance for error is ever-present, injury to the caudal canal and introduction of infection into the spinal canal when using the indwelling needle or cather is a serious possible complication, even more so before the era of the antibiotic.

Spinal and continuous spinal anesthesia and analgesia, particularly the "saddle block" type of anesthesia has had episodes of popularity since the 1920's. This method appears to be coming into greater usage in large hospitals and teaching hospitals, although several of the hospitals formerly using the spinal technique extensively have discontinued this type of obstetrical analgesia.[57]

Paravertebral anesthesia, peridural segmental anesthesia and pericervical infiltration are other methods which have utilized anatomical considerations in securing obstetrical anesthesia. Direct infiltration anesthesia in obstetrics appears to have received a new impetus recently with the realization that injection of the anesthetic solution into a vein did not cause immediate death. Heretofore, this possibility was always a much feared complication. The advantages of a properly administered infiltration anesthesia are great, since there has been demonstrated no mortality due to this method. Other variations of this method are the parasacral and pudendal techniques, more commonly known as parasacral anesthesia and pudendal block. Pudendal block is becoming more universally used; it does not inhibit the uterus, is easy to administer and particularly valuable for the terminal stages of labor.

SADDLE BLOCK ANESTHESIA: DESCRIPTION OF, ANATOMIC CONSIDERATIONS, AND HISTOPATHOLOGIC EFFECTS OF INTRADURAL ANESTHETIC DRUGS

Saddle block anesthesia is a comparatively recent addition to the armamentarium of the obstetrician. Its increasing application to relieving pain in the terminal phase of vaginal delivery is but one indication of its' value and usefulness. Yet, none of the numerous responsible investigators under-estimate the potential hazards of spinal anesthesia, and some have been verbose in their condemnation of its' use.[58]

The first description of a "saddle" anesthesia was made as early as 1928 by Pitkin and McCormack.[44] Others before them[43] had described the areas anesthetized by spinal anesthesia, and nerves in the spinal canal affected, but their work did not include the addition of "weighing" agents in the spinal anesthetic to limit anesthesia to the definite regions so aptly described by "saddle" anesthesia. Pitkin and McCormack contributed the first attempt to control the level of spinal anesthesia by the use of "weighing" agents in the spinal anesthetic to render it hyperbaric and localize the effect of the anesthetic. These workers described a type of low spinal block, introduced into the subarachnoid space in the low lumbar area and affecting only the sacral nerves. The anesthesia resulting from the block was restricted to the "saddle" area of the buttock. Analgesia was apparently limited to the perineum, bordered anteriorly by the symphysis, posteriorly by the lower portion of the sacrum, and down the inner aspects of the thighs for a distance of five or six inches. This particular technique sufficed for the terminal phase of vaginal delivery. Adriani and Roman-Vega[47] and Parmley and Adriani[48] concurred generally with the description of the term "saddle", but modified the technique so as to permit higher levels of anesthesia sufficient to abolish uterine as well as perineal pain. Analgesia extended then as high as the umbilicus, both anteriorly and posteriorly, and involved the legs as well. Bryan[59] states, "the term saddle block is a descriptive one defining the area of the lower abodmen, perineum and thighs."

Although obstetrical spinal anesthesia had been used as early as 1923,[43] and had been thoroughly investigated and enthusiastically reported by Pitkin and McCormack[44] in 1928, none of the methods of regional block had gained any degree of acceptance. When Cleland[60] in 1933 reported, after a study of comparative anatomy, on the pathways of pain from the fundus and birth canal in animals, the more practical aspects of spinal anesthesia in obstetrics in the human were made available. His conclusions, briefly, were that afferent impulses should enter the cord from the human fundus at T 11 and 12; from the cervix, vagina and perineum at S 2, 3 and 4. The accuracy of these conclusions he proved by performing bilateral paravertebral blocks at T 11 and 12, and effectively blocked fundal pain. Then, he anesthetized the sacral nerves by injecting an anesthetic solution caudally, with resultant complete relief of pain in cervix, vagina and perineum. These experiments were utilized by Hingson and Edwards[46] in introducing continuous caudal anesthesia. By thus defining the pain pathways to the uterus, cervix, vagina and perineum, further developments and variations ensued, resulting in "saddle block" anesthesia as the simplest and most practical method of spinal anesthesia in childbirth.

According to Davis, Haven and Givens[61] drugs exert a specific toxic destructive effect on nerve tissue. These investigators were among the first to ascertain, by experiments on dogs, definite changes in the structures of the spinal cord. Various investigators had found changes in the cord, though none of them agreed with one another by finding identical changes. Davis, et al., found that a constant change was an apparent meningeal reaction of some degree. This reaction was more marked with larger doses. (This is not surprising when the volume of anesthetic drug injected intrathecally varied from 10 milligrams up to as much as 250 milligrams during the course of a single operation). There was an inflammatory reaction of the arachnoid, with thickening of the membrane and collections of proliferated arachnoidal cells and of plasma cells in the interstices of the membrane. Exudates were present, of the lymphocytic type. They found that there was organization of this inflammatory reaction with fibrotic scarring of the meninges, more marked in those areas most frequently chosen as sites to be anesthetized. In the ganglion cells themselves there was a moderate degree of swelling, edema of the nuclear membrane, eccentricity of the shape of the nucleus and a finely granular appearance of the Nissl granules about the periphery of the cell. This was interpreted to be a stage of retrograde degeneration, due to the action of the anesthetic agent on the anterior roots. These abnormalities of the ganglion cells were found to disappear in 60 to 90 days. Also observed were swelling and fragmentation of the axis cylinder, plus signs of degenerative changes of the fiber tracts of the cord, which were not, however, of a permanent nature. Others,[62] have stressed the possibility of damage to the cord coverings and structures as being the etiological factors in neurologic complications following spinal anesthesia. In view of the fact that in recent years, in all fields where anesthesia is desired, and spinal anesthesia serves the purpose, there is no hesitation in injecting anesthetic drugs intrathecally, it would appear that the general concensus of opinion is there is little likelihood of damage to the spinal cord structures due to the drug itself.

CONTRAINDICATIONS TO SADDLE BLOCK ANESTHESIA

Saddle block anesthesia can be used in obstetrics when inhalation anesthesia is definitely contraindicated. Still, saddle block anesthesia has its limitations. As with any anesthetic, there are situations and conditions during which time the introduction of any abnormal physiologic state is inadvisable. These contraindications may be separated into two catagories, obstetrical and general contraindications.[63] Obstetrical contraindications are:

(1) Pelvic disproportion.
(2) Placenta praevia.
(3) Abruptio placenta.
(4) Unengaged head.
(5) Necessity for intrauterine manipulations (such as podalic version).

General absolute contraindications are:

(1) Disease of the cerebrospinal system such as meningitis, cranial hemorrhage, tumors, or poliomyelitis.
(2) Moribund or comatose condition.
(3) Sepsis with blood stream infection.

(4) Pernicious anemia with or without cord symptoms.

(5) Arthritis, spondylitis, and other diseases of the spinal column rendering spinal puncture impossible.

(6) Tuberculosis, or metastatic lesions in the spinal column.

(7) Pyogenic infections of the skin, at or adjacent to the site of puncture.

General relative contraindications:

(1) Hysteria or excessive nervous tension.

(2) Chronic backache.

(3) Preoperative headache of long duration, or a history of migraine.

(4) Hypersensitivity to drugs used.

(5) Possibility of severe hemorrhage.

(6) Shock.

(7) Cardiac decompensation, massive pleural effusion and markedly increased abdominal pressure (as in ascites or tumor).

(8) Hypotension, due to Addison's disease or associated with shock.

(9) Hemorrhagic spinal fluid.

(10) Extreme obesity.

AIM OF SADDLE BLOCK ANESTHESIA

The ideal obstetric anesthetic and analgesic agent is the one which will provide absolute safety for both the mother and the fetus. Many investigators have labored long and hard in the search for such a technique. Some progress has been made in this search. From the standpoint of the fetus the spinal method of obstetric anesthesia cannot be surpassed because toxicologic drug reaction and depression are absent. From the standpoint of the parturient, complete subjective relief during the most painful and traumatizing period of childbirth is secured, with a minimum of discomfort present in obtaining such relief. The factor of safety to the parturient is of momentous importance, and it is with this goal in mind that saddle block anesthesia was introduced to obstetrics.

CORRECT TECHNIQUE IN SADDLE BLOCK ANESTHESIA

Those obstetricians whom have had extensive experience with saddle block anesthesia agree that for maximum safety to the fetus spinal anesthesia has no equal. The welfare of the fetus being assured, so far as the anesthetic is concerned, the main objections have to do with the possible reactions of the anesthetic agent with respect to the mother, and secondarily, the fetus. Aside from the possibilities that the patient may be sensitive to the anesthetic agent used there can exist little grounds for other objections provided the proper technique of spinal puncture is carried out every time such a procedure is undertaken. There have been fatalities with spinal anesthesia,[64] or, at least, spinal anesthesia was a contributing factor.[65]

The possibility that a patient to whom an anesthetic drug is given intrathecally may be sensitive to the drug always exists. Therefore, the proper precautionary measure to employ is to test the individual for sensitivity to the particular drug which is to be used. This can easily and simply be done by injecting 0.1 to 0.2 cubic centimeters of the drug intradermally, or by instilling 4 or 5 drops into one nostril.[66] It is apparent that only those anesthetic drugs should be chosen which have been accepted by the Council on Pharmacy and Chemistry, and which have stood the test of clinical trial.[67]

A thorough knowledge of the anesthetic drug to be used, effective concentrations, limitations and toxicity, is always desirable. Too often agents are used with whose properties the operator is unfamiliar; he does not know what to look for by way of undesirable side effects, does not recognize them when they manifest themselves, and does not know what to do to counteract, or minimize such effects. The anesthetic drug is the working tool, and must be used properly.

Preanesthetic medication is an all important must. In the case of any spinal anesthesia this consists of three-fourths grain of ephedrine sulfate, injected subcutaneously fifteen minutes before the anesthetic is given. For convenience, this usually can be given in a mixture with 1 per cent procaine hydrochloride (novocaine) which is used for the intradermal wheal and infiltration of the subcutaneous tissues and structures about the interspinous ligament.[68] Analgesics and sedatives may be given during the course of labor, at the discretion of the attending physician, though it must be remembered that these latter drugs are not the antidote in spinal anesthesia.

The apparatus used for the usual saddle block anesthesia is extremely simple. Needed are only a large hemostat, a 2 cubic centimeter hypodermic syringe, a spinal needle (20 to 22 gauge) with a short bevel, a short $1\frac{1}{2}$ inch, 22 gauge needle to withdraw anesthetic solution from the ampule, an ampule cutter, an alcohol sponge, a merthiolate sponge and an ampule of the anesthetic to be used. If skin and subcutaneous tissues are to be anesthetized, an ampule of epinephrine or ephedrine sulfate in solution, an ampule of 1 per cent solution of procaine hydrochloride (novocaine), a 2 cubic centimeter hypodermic syringe, a $1\frac{1}{2}$ inch, 23 gauge needle and a small mixing glass are required. Sterile gloves and towels are required for proper asepsis. The anesthetic to be used for the spinal injection should always be drawn into one of the 2 cubic centimeter hypodermic syringes beforehand, and placed to one side so that it can be attached to the spinal needle as quickly as possible.

The patient is placed in a sitting position with her legs hanging over the edge of the bed, or delivery table, whichever is used, her back entirely bare, supported by an assistant and encouraged to flex her back so as to separate the spinous processes of the vertebrae as much as possible. The area over the spine where the puncture is to be made (on a level with the iliac crest) is painted first with the alcohol sponge, then with the merthiolate sponge, and allowed to dry. One edge of a sterile towel is folded over the gloved fingers and placed on the bed or delivery table as closely to the buttocks of the patient as possible, without contaminating the gloved hands. The fourth interspace is located, as well as the spinous processes of L 4 and 5. The level of the iliac crest should be marked by having the assistant place the edge of the palm of the hand at the lateral iliac crest. A skin wheal is raised over the interspace selected for intradermal injection using the $1\frac{1}{2}$ inch, 23 gauge needle on a 2 cubic centimeter hypodermic syringe; then the deeper subcutaneous tissues are anesthetized by slowly advancing the needle straight into the area to be penetrated by the spinal needle, withdrawing the needle partially and directing the needle first to one side, then to the other, of the interspinous ligament, injecting the solution as the needle is advanced in each instance. The hypodermic syringe is filled with 1 one per cent procaine and at least 15 milligrams of epinephrine or ephedrine sulfate solution.

The spinal needle is then introduced into the spinal canal, with the bevel of the needle facing laterally as the point enters the dura (if possible), the stylet is withdrawn and the spinal fluid is allowed to drip until clear and a free flow of fluid is obtained. If a free flow of fluid is not obtained, replace the stylet, either advance the needle a fraction of an inch further (if it is felt that the needle is not advanced far enough), or withdraw the needle and try again. When the needle point is in the spinal canal, turn the needle so that the bevel of the needle is pointing down (caudad). Attach the hypodermic syringe filled with the anesthetic solution to be used and previously prepared, to the spinal needle securely, withdraw a small amount of spinal fluid (0.1 cubic centimeters)[66] so as to ascertain whether the end of the spinal needle is still within the spinal canal. Select a time for injection between contractions, and inject slowly to the count of "one-and-two-and-three",[66] wait 10 seconds, reinsert the stylet and withdraw the needle not too quickly and not too slowly. Place a gauze bandage over the site of puncture with tape. The patient should remain sitting for exactly 30 seconds following the injection, beginning with the injection. The patient is then assisted in assuming the recumbent position, two pillows being placed under her head. The pulse, blood pressure, respirations and fetal heart tones should be checked before administration of the anesthetic, immediately after lying down, and every five minutes thereafter for twenty minutes.

Perhaps a few do's and don't's are pertinent.

The cleansing and sterilizing of apparatus used in the administration of spinal anesthesia should be carefully supervised. Do not rinse apparatus, needles, hypodermic syringes, etc., with saline solution, use them dry, particularly when using nupercaine.[66]

The contents of the ampules should be inspected carefully and should be clear and free from insoluble particles and crystals. If there is even a faint suggestion of turbidity or cloudiness, discard the ampule. Ampules containing spinal anesthetic drugs should be sterilized by soaking them in a non-irritating, colored sterilizing solution such as a 1 to 1,000 solution of zephiran. The addition of a dye such as methylene blue to the solution in which ampules are immersed is of value in detecting the occasional defective ampule into which the sterilizing solution has leaked. Do not use sterilizing solutions containing alcohol, phenol or formaldehyde.[61]

The spinal needle should always be tested for the occasional defective needle by taking the needle between thumb and middle finger, with the stylet out, and arcing the needle once or twice. This procedure will detect the weakened or defective needle ahead of time, and prevent its breaking off during or after insertion.[69]

It is advisable to perform the operation of spinal anesthesia in the bed as much as possible, in order not to frighten the patient or to render them apprehensive in any degree by too obvious and painstaking preparations, and thus over-impressing the patient with the seriousness of the procedure. Saddle block anesthesia has become a relatively commonplace procedure, but one should never underestimate the psychic effect on a patient already extremely apprehensive and upset. Spinal anesthesia should never be forced upon a patient - the type of anesthesia to be rendered should be talked over with the patient and agreed upon before hand.

The assistant supporting the shoulders of the patient sometimes has a difficult task eliciting the full cooperation of the patient. Asking the patient to flex, or "arch" the back, and having her perform this maneuver are two different things. The assistant can render valuable aid by having the patient fold her arms over her chest, each hand grasping the opposite upper arm, the better to keep the patients' hands away from the area in which the spinal puncture is being made. Never should pressure be exerted on the patients' head or the back of her neck in order to induce the patient to flex her back more. This practice may be permissable for the ordinary spinal anesthetic, but with the pregnant woman, should be thoroughly discouraged.

In endeavoring to introduce the spinal needle into the spinal canal the needle should be held with the thumb and first two fingers of the hand with the index finger on the knob of the stylet, and the shaft of the needle held between the thumb and middle finger. Holding the spinal needle in this fashion enables one to guide the needle accurately, and better to feel degrees of resistance as the needle passes through the tissues. Using the thumb on the know of the stylet is considered poor technique.[70]

The area selected for insertion of the spinal needle should be in line with the spinous processes of the vertebrae, and directed in such a manner as to avoid going lateral to the ligamentum spinosum. The needle should enter the skin just below the lower border of the 4th lumbar spinous process, and pushed into the tissues on a line at right angles with the back at that point. Too often the simple anatomical position of the spinous processes, when the back is flexed, is forgotten, and the needle is directed much too cephalad.[71]

If the spinal canal is not located on the first try, then the spinal needle should be almost completely withdrawn, until the tip is just beneath the skin, and then redirected again. The needle should be advanced cautiously; when it is thought that the tip of the needle is within the spinal canal, the stylet should be withdrawn, and sufficient time allowed for spinal fluid to reach the end of the needle and be seen. Then, the stylet should be replaced, the needle turned several times and the stylet withdrawn again, and the flow of spinal fluid should again be given time to reach the end of the needle.

Should a bloody tap be secured which does not clear up in the first few drops, the needle should be withdrawn and reinserted in the next higher interspace.[68] Careless prodding, nor repeated attempts in a single vertebral space should be done. Rather, if an apparently perfectly directed needle results in a dry tap, withdraw the needle, make certain the patient is properly positioned, inspect the entire vertebral column, locate the proper interspace and try again.

Attempting to do a spinal puncture through a small hole in a sheet is pure folly, although it looks good. The entire vertebral column should be visible, so that any corrections necessary in directing the needle can be easily and quickly visualized.[72]

PURPOSE OF EXPERIMENT WITH SADDLE BLOCK ANESTHESIA

The purpose of this experiment is to determine the relative merits of saddle block anesthesia when various anesthetic agents are used, these being: (1) "Heavy" nupercaine

(2) Metycaine

(3) Metycaine with epinephrine

These three anesthetic agents are compared as to (1) duration of analgesia, (2) relief of pain, (3) toxicity, (4) undesirable side effects, (5) rapidity of onset of analgesia, and (6) general acceptibility for saddle block anesthesia in obstetrics.

MATERIAL

The 110 patients studied were delivered with saddle block anesthesia administered when they were in the terminal stages of labor, (i.e., at the end of the first stage of labor, or just beginning the second stage of labor). Providing there were no contraindications, the patients were given saddle blocks as they presented themselves for delivery, no effort being made to limit the anesthesia entirely to multiparous women, or to primiparous women. The solutions used were:

Solution #1 - "Heavy" nupercaine*

*Supplied by Ciba Pharmaceutical Products, Inc., Summit, New Jersey.

Solution #2 - Metycaine*

Solution #3 - Metycaine with epinephrine*

Solution #1 ("heavy" nupercaine) is a complex amine derivative of quinoline, the hydrochloride of alpha-butyloxycinchoninic acid diethylethylenediamide. Nupercaine forms hygroscopic crystals which are colorless, tasteless, and odorless. It is alcohol and water soluble. The aqueous solutions are stable and may be boiled without deterioration. When in contact with the slightest amount of alkali, and dissolved in water, nupercaine is precipitated in the form of an insoluble base.[66]

Nupercaine has a selective affinity for nervous tissue, paralyzing peripheral nerves without initial stimulation. Nupercaine is considered to be more potent than any of the other local anesthetics, and can be used in greater dilutions and/or lower total dosage. Bennett[73] et al, have found nupercaine to be minimally effective in dilution 66 times greater than cocaine, and 166 times greater than procaine (novocaine). "Heavy" nupercaine was administered in 1 cubic centimeter dosage of a dextrose-nupercaine mixture, each cubic centimeter containing 2.5 milligrams nupercaine and 50 milligrams of dextrose in sterile distilled water. In all, 59 patients received "heavy" nupercaine.

Solution #2 (metycaine)[74] belongs to the group of substituted piperidino-alkyl benzoates. It is an odorless, white, crystalline powder, easily soluble in water, alcohol and chloroform, but insoluble

*Eli Lilly and Company, Indianapolis 6, Indiana.

in ether and in olive oil. Solutions of metycaine hydrochloride are stable and retain their potentcy after boiling. Metycaine is considered to be less potent than nupercaine, but a third more potent than procaine (novocaine). The solution used in the experiment was a plain 3 per cent metycaine in 5 per cent dextrose, with Ringer's solution as a vehicle, administered in 1 cubic centimeter dosage to 22 patients.

Solution #3 (metycaine with epinephrine) was a commercially premixed solution of 3 per cent metycaine in 5 per cent dextrose containing 0.36 milligrams of epinephrine per 1 cubic centimeter of the anesthetic solution, given in 1 cubic centimeter dosage to a total of 29 patients.

The history and use of epinephrine in spinal anesthesia is interesting. Heinrich Braun75 early in 1900 realized the value of epinephrine because of its vasoconstrictor action which resulted in a decrease in the flow of blood to an anesthetized area, and slowed absorption of the anesthetic agent. The German investigators Bier, Donitz, and Klapp (according to Whitacre and Potter)[76] advanced the use of epinephrine in spinal anesthesia in the early part of the 1900's. This practice soon fell into disrepute, but in recent years other investigators called attention to the value of adding epinephrine to the spinal anesthetic. Pitkin[77] noted that epinephrine, when used in spinal anesthesia, stabilized the blood pressure and intensified and prolonged the anesthesia. Pitkin and McCormack,[44] in 1928, introduced a "controllable" spinal anesthesia, using epinephrine in the anesthetic agent. Romberger[72] began adding epinephrine to his spinal anesthetic solutions in order to prolong anesthesia after listening to Doctor A. E. Hertzler remark that in early surgical procedures, if he wanted the anesthesia to last a few hours he added adrenalin to the solution. Romberger began to use this technique, and tried various solutions, including the addition of epinephrine in varying concentration. He professed to have had little success at first, but with further cautious experimentation was able to secure very gratifying results. Others have since contributed to this work, notably Lund and Rumball.[78]

Cullen and his associates[79] found that the use of epinephrine with procaine definitely prolonged the duration of spinal anesthesia. The use of epinephrine intrathecally had received no great interest, principally because of the possibility of damage to the spinal cord by vasoconstricting drugs, either by direct action on the nerve tissue itself, or by decreasing the effective blood supply to the cord. Potter and Whitacre[80] state that to the best of their knowledge there is no good clinical evidence that the injection of epinephrine in proper concentrations into the spinal fluid is a dangerous practice.

Epinephrine is a secondary alcohol, its full chemical name being 3,4-dihydroxy-2-phenyl-beta-methylaminoethanol. Epinephrine is closely related to tyrosine, an amino acid. It is a sympathomimetic drug. Its most important property, insofar as spinal anesthesia is concerned, is its vasoconstricting ability and prolongation of spinal anesthesia when injected into the spinal canal, as previously mentioned. In the blood stream epinephrine has a pressor effect. Up to the present, the mechanism by which epinephrine exerts its action in the spinal fluid, how it affects the nerve roots, how it prolongs anesthesia, is not known. This may be due, in part at least, to the anesthetic potentialities of the vasopressor drug itself, as stated by Leimdorfer,[81] or may be the result of ischemia of nervous tissue, and consequent delay in absorption of the anesthetic agent resulting from vasoconstriction produced by the epinephrine.

The process of nerve block has been studied most extensively by the use of local anesthetics. Nerve block may be caused by (a) mechanical compression, (b) cooling, (c) various chemicals and narcotics such as ether, chloroform, cocaine and related substances, (d) anodal effects of direct current and (e) lack of oxygen. Local narcosis involves a decreased excitability, a decreased reactivity, and a slowing of conduction. Complete block occurs when the decreased reactivity results in an action potential of the affected region that is too feeble to serve as a threshold stimulus for the following section of normal nerve. On the other hand, if the action potential in a subnormal narcotized area is still capable of stimulating the succeeding normal nerve fiber, the impulse will be conducted in a perfectly normal fashion over the remainder of the nerve. Analysis of the action potentials that are conducted beyond such a region of incomplete block reveals that as soon as the impulse has passed the region of block the action potentials regain their normal form and intensity, the only evidence of incomplete block being a slight delay in the speed of conduction through the block.[82]

METHOD

This is a study of 110 cases of saddle block anesthesia carried out at the University of Nebraska Hospital, Department of Obstetrics and Gynecology, between November 4, 1950 and January 15, 1951. During this period of time the spinal anesthetics were administered by two residents in obstetrics and the one interne on the service at that time. None of them had had any particular training in spinal anesthesia other than that associated with one year of internship, although one of the resident staff had had two years of private practice during which time the use of spinal anesthesia in obstetrics in his practice had been negligible. All patients were given saddle block anesthesia, selected only in that they presented none of the usual contraindications to spinal anesthesia, and provided ample time was available before delivery to permit submitting them to saddle block.

All patients were carefully followed in their labor. Analgesic drugs were given as sparingly as possible, and given only in those cases in which the patient complained too much, or, from previous experiences, expected and demanded something for her pain. The proper moment for administering the anesthetic was determined by the progression of labor, dilatation of the cervix, frequency, length and efficiency of the uterine contractions and fixation of the fetal head. In as much as was possible anesthesia was instituted at 5 or 6 centimeters of cervical dilatation in multiparas, and near 8 centimeters dilatation in primiparas. All the patients received the injections on the delivery table, having been observed in the labor room as labor progressed, wheeled into the delivery room in their beds when sufficient progress in labor had been made, and prepared for the spinal anesthetic. While under observation the patients' blood pressure, pulse, respirations and temperature were carefully recorded, and the fetal heart beat noted. Rectal examinations were kept at a minimum, but were frequent enough so that accurate following of the course of labor was possible. The technique of injection was carried out according to the procedure demonstrated by Parmley and Adriani[83] and used without significant modification only insofar as other drugs plus Nupercaine were involved. There was no variation in technique, lumbar site of injection, rapidity of injection, or time the patient was allowed to sit up before being placed in the recumbent position, except in that variation necessarily present when more than one individual is administering the anesthetic. The injections of the anesthetic solution were timed to take place between contractions, so as to minimize the effects of currents in the spinal fluid carrying the solution upward. As soon as the patient was in the supine position, two pillows were placed under the head so that it was well above the highest level of the lower spine. The blood pressure was taken immediately after injection of the drug, and every five minutes thereafter for the first thirty minutes, and every fifteen minutes thereafter until one hour postpartum. Oxygen and emergency drugs including ephedrine, methedrine, Coramine and (soluble) sodium amytal were kept immediately available.

In this experiment, the preanesthetic medication of 15 milligrams ephedrine sulfate was dispensed with in order to study the effects of epinephrine injected with the spinal anesthetic solution and thus ascertain whether this method of administering epinephrine prevented the fall in blood pressure, as well as prolonged anesthesia.

After the patient had assumed the supine position, she was not allowed to change position or move until it was determined that the anesthetic had taken its affect and there was analgesia present in the perineum. After testing the height of analgesia and determining that there was to be no further analgesic advance and the anesthetic was fixed, the legs were placed in stirrups, and the delivery proceeded. All patients were catherized and the bladder emptied. The position of the fetal head, presence or absence of membranes, dilatation of cervix, etc., were determined by sterile vaginal examination. Low outlet forceps were used in all cases. Oxytocics were administered, 1/320 grain ergotrate being given intravenously with the anterior shoulder. A left medio-lateral episiotomy, in most cases, was performed whenever indicated.

SADDLE BLOCK ANESTHESIA

TABLE I

110 CASES

Duration	Solution #1*	Solution #2*	Solution #3*
½ - 1 hour	2	0	0
1 - 1½ hours	11	5	4
1½ - 2 hours	22	11	9
2 - 2½ hours	16	6	11
2½ - 3 hours	6	3	3
3 plus hours	2	0	1
Failure (2.7%)	0	2	1
Total	59	22	29

*Note: Solution #1 - "Heavy" Nupercaine
Solution #2 - Metycaine
Solution #3 - Metycaine with epinephrine

Table I indicates the length of analgesia obtained by each of the anesthetic agents used. The failures, (2.7%) were, in all probability, due to failure to properly introduce the anesthetic agent into the spinal canal, and were not due to a faulty anesthetic agent, insofar as could be ascertained.

RESULTS AND DISCUSSION

The predetermined policy in this experiment was to use only single saddle blocks late in labor. In the main, this procedure was quite successful, there being only 3 cases which required a second injection, all of which were successful and none of which exhibited any untoward effects as a result of the repetition of the block. It is to be emphasized that the saddle block was administered only as a terminal procedure, when labor was well along, cervical dilatation had reached a stage permitting passage of the presenting part, and safe application of the forceps. There was no effort made to utilize saddle block during the first stage, as Shepperd[84] apparently advocated.

The three anesthetic solutions used have previously been discussed. Table I (page 37) tabulates the duration of pain relief secured in 110 cases. "Heavy" nupercaine, though used in smaller quantities, appeared to render longer duration of anesthesia; in 2 cases perineal analgesia was present 3 plus hours after saddle was administered. The 2 cases having only $\frac{1}{2}$ to 1 hour duration of pain relief are difficult to explain; perhaps the technique was faulty, and inadvertant barbitage was present, with too much spinal fluid being aspirated and mixed with the anesthetic solution. Spinal fluid has a pH of about 7.4, and is sufficiently alkaline to cause a precipitation of the nupercaine base from aqueous solutions of the hydrochloride.[85] It is possible the nupercaine was precipitated, and very little anesthetic agent was available to effect ideal analgesia.

Metycaine, without epinephrine, gave an average duration of pain relief of about $1\frac{1}{2}$ to 2 hours. Three cases had perineal analgesia lasting from $2\frac{1}{2}$ to 3 hours. Results here would appear to parellel those reported elsewhere.[69]

Metycaine with epinephrine rendered a significant prolongation of pain relief. The average duration of pain relief was about $1\frac{1}{2}$ to $2\frac{1}{2}$ hours. Three cases had perineal analgesia lasting $2\frac{1}{2}$ to 3 plus hours after saddling. The use of epinephrine intrathecally is discussed more fully by Andros, et al.,[69] who mention administering epinephrine intrathecally (0.4 cubic centimeters of 1-1000 epinephrine mixed with 0.6 cubic centimeters of 10 per cent dextrose) and securing complete analgesia for a period varying from 90 to 150 minutes. One of their patients had outlet forceps extraction, plus episiotomy and repair with epinephrine alone. Potter and Whitacre[80] failed to get prolongation of anesthesia with epinephrine intrathecally. The results of this experiment would support the findings of Andros, et al.,[69] and Lund and Rumball.[78]

Relief of Pain is tabulated in Table II (page 40). Of the patients given "heavy" nupercaine, 77.9 per cent experienced complete (uterine and perineal) relief of pain, and 20.3 per cent experienced perineal relief of pain. Of the patients given metycaine, 81.8 per cent experienced complete relief of pain. Two patients, 9.09 per cent, experienced perineal relief of pain, and two, 9.09 per cent, of the saddles with mety-

SADDLE BLOCK ANESTHESIA

TABLE II

110 CASES

Relief of Pain	Solution #1*	Solution #2*	Solution #3*	Total
Complete	46	18	28	92
83.6%				
Perineal	12	2	0	14
12.7%				
Partial	1	0	0	1
0.9%				
None	0	2	1	3
2.7%				

*Note: Solution #1 - "Heavy" nupercaine
Solution #2 - Metycaine
Solution #3 - Metycaine with epinephrine

Table II indicates the per cent of patients obtaining complete (uterine and perineal), perineal only, partial and no relief of pain. The failures, (2.7%) were, in all probability, due to failure to properly introduce the anesthetic agent into the spinal canal, and were not due to a faulty anesthetic agent, insofar as could be ascertained.

caine were failures in that no relief of pain was experienced. Of those receiving metycaine with epinephrine, 96 per cent experienced complete relief of pain. One of the saddles with metycaine with epinephrine was a failure. The 3 cases having no pain relief were evidently due to faulty technique in administering the anesthetic. However, one cannot be definite in assigning to faulty technique the cause for the failures. Of particular interest is the observation made by Hingson (in a personal communication to Walton)[86] that colored patients require more of the anesthetic solution than white patients, approximately one-half again as much. Hingson used nupercaine; there apparently is no evidence that more metycaine would be required. In at least two of the patients observed the dosage may not have been enough. In these cases every precaution was taken to inject the anesthetic solution intrathecally; the 0.1 cubic centimeter of spinal fluid was aspirated preparatory to injecting the anesthetic, and spinal fluid was obtained, yet the analgesia rendered was quite unsatisfactory in as much as complete perineal and uterine pain was not obliterated.

The most opportune time to administer saddle block anesthesia is, in some cases, most difficult to determine. Far less difficulty was experienced with multiparas in deciding when to give the saddle because past performances were known, the passages were known to be adequate, the powers were previously checked by the attendant watching the patient, and the perineum had previously been subjected to the stretching required to permit extrusion of the presenting part; the only difficulty encountered was not administering the saddle block early enough and thus depriving the patient of the benefits of the anesthesia. Primiparas presented a problem in that anesthesia could easily be administered too early, and in some cases appeared to stop labor, though this may be only apparent due to the diminished efficiency of voluntary "pushing" efforts on the part of the patient and progress of labor depending, then, only on the contractions of the uterus. The most opportune time for saddle was judged to be when the cervix was eight centimeters dilated, as determined by rectal examination. In three instances such was not the case; the obstetrician attending preferred to forego subjecting the patient to another injection and delivery was affected by ether inhalation anesthesia. Table III (page 43) presents the time elapsed between saddle block and delivery. Unfortunately, there is no possibility of distinguishing primiparas from multiparas. The greatest number of saddles, 72 in number, were administered 30 minutes to 1 hour before delivery. Twelve saddles were administered from 1 hour to 2 hours before delivery. As seen, 23 saddles were administered only 30 minutes before delivery - the impression being that these were multiparas either relatively far into the second stage, or making very rapid progress in their labor. Particular note was made of the presenting part and its 'station' in the pelvis before administering the saddle block.

As a rule, the institution of saddle block resulted in much less

SADDLE BLOCK ANESTHESIA

TABLE III

110 CASES

TIME FROM SADDLE TO DELIVERY

30 minutes or less	23 cases
30 minutes to 1 hour	72 cases
1 hour to 1½ hours	10 cases
1½ hours to 2 hours	2 cases
Cases not delivered	3*

Table III tabulates the time between administration of the saddle block anesthesia and the end of the second stage. *Note: The 3 cases which did not deliver at the time the initial saddle was administered subsequently delivered under ether anesthesia.

restlessness on the part of the patient. The occasional apprehensive patient, particularly primiparous patients, interpreted pressure as pain, but when informed of the probable nature of the sensations they were experiencing, quieted almost immediately. Those who required no supplementary anesthesia but had some discomfort complained of pressure in the low back, or in the perineum during delivery of the head and shoulders of the fetus. Inhalation anesthesia was used in those patients who came to delivery with waning spinal anesthesia, or who complained of severe pain during attempted delivery. These patients were in the minority, only 18 patients requiring more than reassurance.

There have been many theories advanced as to the cause of the fall in blood pressure in spinal anesthesia, none of which will be mentioned here. There are a number of factors responsible, most important of which are: (1) the sudden vasodilatation incident to paralysis of sympathetic vasomotor fibers and (2) loss of muscle tone with decrease in venous pressure, venous return, and cardiac output. In this experiment 11 cases exhibited a systolic blood pressure drop below 100 millimeters of mercury, the lowest of which was 76/60. Twenty-six cases exhibited a blood pressure fall greater than 10 millimeters of mercury, the greatest drop being 50 millimeters of mercury. Of the 59 patients receiving "heavy" nupercaine, 10 patients exhibited a drop in systolic blood pressure below 10 millimeters of mercury. Of the 24 patients receiving metycaine, there was a drop in systolic blood pressure varying from 4 millimeters of mercury to 50 millimeters of mercury, and almost every patient exhibited a drop in systolic blood pressure, 10 of them exceeding 10 millimeters of mercury. The 29 patients receiving metycaine with epinephrine exhibited less drop in systolic blood pressure, 22 of them exhibiting no appreciable drop in blood pressure.

Patients whom exhibited no symptoms, and no drop in fetal heart tones below 80 beats per minute were not treated until the systolic tension was below 90 millimeters of mercury. Usually, deep breathing, oxygen inhalation and simple elevation of the patients' legs sufficed to correct blood pressure fall. In more serious cases, with fetal heart slowing, and blood pressure falling, ephedrine sulfate (15 to 25 milligrams) was injected intravenously.

There were no serious neurologic complications. In 6 patients receiving "heavy" nupercaine there were severe headaches; in three patients there were nausea and vomiting, though it is questionable whether this was due to toxic effects of the "heavy" nupercaine, or due to intra-abdominal tension in the process of delivery.

BRIEF DISCUSSION OF COMPLICATIONS IN SADDLE BLOCK ANESTHESIA, AND TREATMENT

A review of the literature presents a horrifying picture of the postanesthetic results of spinal anesthesia. A more realistic outlook has since been adopted, due to the education of those condemning spinal anesthesia, and a critical analysis of the facts. Trent and Gaster[65] critically reviewed many cases of so-called anesthetic deaths, and showed that out of 54,128 deaths, only 8 were due to spinal anesthesia. These 8 patients were judged to be poor operative risks who were undergoing emergency abdominal operations. The highest mortality, directly attributable to the anesthetic, occurred in avertin-ether and cyclopropane anesthesia. This was substantiated by Dealy[87] in another investigation of so-called spinal anesthetic deaths.

The most common complication of spinal anesthesia is hypotension. In saddle block anesthesia this is reduced to a minimum because of the relatively small area involved, and thus there is a proportionately smaller overall vascular dilatation and loss of muscle tone. Epinephrine or ephedrine can be administered to those patients having a fall in blood pressure. Other measures are the administration of 100 per cent oxygen, and raising the legs to the vertical.

Postanesthetic headache may occur 48 hours after anesthesia. There are many theories to account for the so-called "spinal headaches".[88,89,90] Most authorities agree that the most important cause is the loss of spinal fluid, probably due to the size of the needle used and the technique of puncture, escaping from the spinal canal along the path of the spinal needle and thus into the tissues.[91] Jorgenson et al.,[92] recommend that the needle be left in place for 10 seconds and then removed slowly. The treatment varies, some recommending early assumption of the sitting position, early ambulation, and letting out as little spinal fluid as possible on puncture.[66] Weintraub[93] advocates firm abdominal pressure as the treatment, by means of binders. Some[88] recommend the injection of peridural and subarachnoid with saline solutions. Others[57] recommend that the patient be placed flat on her back in bed, with no pillows being used under the head, and stimulants such as caffeine being used in some cases. The most efficacious treatment has not been decided upon. Post-spinal headache is the most common complication of saddle block anesthesia.

Neuropathies in the obstetrics are a rare complication. The most common complication is foot drop.[94] The first sign of imminent trouble is sciatic pain during labor. These injuries may easily be caused by the fetal head or by instruments traumatizing the lumbosacral cord structures.

SUMMARY

1. In the preceding paragraphs a brief history of anesthesia has been presented, particularly the history of anesthesia in obstetrics.

2. The anatomic approach to the relief of pain in childbirth has been described in a technique called "saddle block" anesthesia, a form of spinal anesthesia.

3. The correct technique of administering "saddle block" anesthesia has been described, and suggestions for improving the performance of the

technique have been made.

4. An extensive list of contraindications to the use of "saddle block" anesthesia in childbirth has been presented.

5. An experiment has been carried out, using "saddle block" anesthesia, on a total of 110 patients. Materials and methods have been presented in detail. Three anesthetic agents were used, "heavy" nupercaine, metycaine, and a commercially prepared solution of metycaine with epinephrine.

CONCLUSIONS

The following observation were made, with respect to:

1. Duration of analgesia - "heavy" nupercaine was found to render a longer period of analgesia, in most instances, than either metycaine or metycaine with epinephrine. Metycaine with epinephrine significantly prolonged analgesia, when compared with metycaine alone.

2. Relief of pain - metycaine with epinephrine provided complete relief of pain in every case, with the exception of the one case, which was a failure; this was attributed to failure in introducing the anesthetic solution into the spinal canal. Metycaine alone provided 81.8 per cent complete relief of pain, and 9.09 per cent perineal relief of pain, with two failures, attributed to faulty technique. "Heavy" nupercaine produced the lowest percentage of complete relief of

pain, 77.9 per cent. There were no failures in the "heavy" nupercaine series. Of the "heavy" nupercaine series, only 20.3 per cent had perineal relief of pain.

3. Toxicity - none of the anesthetic drugs produced general symptoms of toxicity, evidenced by an initial depression followed by nervous excitement with loss of coordination, progressing to a state of clonic convulsions and ultimate death.

4. Undesirable side effects - the use of epinephrine with the anesthetic, metycaine in this instance, aids materially in preventing a fall in blood pressure, or hypotension. Metycaine alone resulted in a high percentage of systolic blood pressure decline, more persistent than that which resulted from the use of "heavy" nupercaine. The nupercaine series exhibited a greater incidence of postspinal headaches, though this complication may not be rightly attributed to the spinal anesthetic agent used. There was an increased incidence of nausea and vomiting in the "heavy" nupercaine series while the patient was under the analgesic influence of the drug. Nausea and vomiting, however, could have been caused by other factors, such as increased intra-abdominal tension during the course of delivery, position of the patient, psychic influences, and prolonged anesthesia. There were no serious neurologic complications noted in any of the 110 patients observed.

5. Rapidity of onset of analgesia - no definite conclusions could be drawn concerning the rapidity of onset of analgesia because of

the variation attendant in each patient's conception of analgesia. The over all elapsed time between onset of analgesia in the perineal region was 4 to 6 minutes, and depending upon the height of analgesia, uterine analgesia in 7 to 8 minutes.

6. General acceptibility for "saddle block" anesthesia in obstetrics - metycaine with epinephrine, on the basis of duration of analgesia (second to "heavy" nupercaine), relief of pain (complete in all patients), toxicity (no toxicity demonstrable), and undesirable side effects (less fall in systolic blood pressure, fewer headaches, less anusea and vomiting), appears to be the anesthetic solution of choice.

There are many critics of spinal anesthesia, who stress its' potential dangers. Many physicians use spinal anesthesia with a supreme carelessness. Naturally, knowing how some go about the process of administering spinal anesthesia, they would not care to submit, themselves, to spinal anesthesia. Doctor I. S. Ravdin,[95] in one of his lectures at the Mid-West Clinic (Omaha, Nebraska, 1951), stated that spinal anesthesia was the safest anesthetic in his experience; that to save his liver and other organs from the assault perpetrated by ether and other inhalation anesthetics, he would much rather submit to a spinal anesthetic - he had had two spinal anesthetics, and was perfectly willing to have a third, should necessity demand it.

There are many critics of "saddle block" anesthesia. Doctor J. P. Greenhill[96] is the most noted of these. He is perfectly willing to allow surgical patients to be given spinal anesthetics, but not the gravid woman. The reasons he cites are perfectly valid, and are two in number: the anesthetic may be forced up to the medulla oblongata, if uterine contractions are present and not relieved by analgesics. Second, the effects of spinal anesthesia on the circulation, combined with the characteristic circulatory changes in pregnancy, render spinal anesthesia particularly dangerous. The proper technique in "saddle block" anesthesia has been stressed. Any one using the proper technique will not inject the anesthetic solution into the spinal canal while there is a contraction present or imminent, and if anesthetic solution were forced up to the medulla oblongata, proper and efficient use of the breathing bag will forestall a possible fatality.

There is no doubt that "saddle block" anesthesia has certain advantages over other types of spinal anesthesia and inhalation anesthesia. "Saddle block" anesthesia is a boon to the patient, to the baby and to the physician. To the patient, the gravid woman, it provides a high degree of comfort, and allows her to be carried through the most difficult and painful stages of childbirth with a minimum of discomfort. To the fetus, maximum safety is assured. There is no toxicologic drug reaction, and depression and narcosis in the baby is absent. The trauma to the baby's head is minimized, because the "bearing down" reflex is eliminated - the baby's head is used as a gentle dilator, not a battering ram. To the physician, the advantages are many. "Saddle block" anesthesia can be used in many patients he would not dare trust to inhalation anesthesia, such as cardiac patients, or patients with respiratory diseases, or diabetic patients, or patients with liver disturbances. The danger of aspiration of vomitus, always imminent with inhalation anesthesia, is eliminated. The "saddle block" is simple to administer, and renders complete relief of pain. It is relatively safe to administer, and when given properly, has an almost immediate effect in relieving pain. The physician can feel that he has done everything possible to help the patient, and in doing so, has protected both his patients at the same time.

One must remember, however, that "saddle block" anesthesia is potentially dangerous - in fact, any method of anesthesia is potentially dangerous. The method cannot be used indiscriminately by those untrained in its use. Doctor William Keettel[64] of the University of Iowa, related in the course of one of his lectures of the death of a woman from spinal anesthesia, due to respiratory paralysis. It can happen, particularly if ignorance accompanies brashness. No physician should administer a "saddle block" anesthetic without first knowing the properties of the drugs he is preparing to use, the proper technique of administering "saddle block", the contraindications to its use, the early recognition of complications and the early and efficacious institution of the proper measures in the treatment and prevention of these complications.

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