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NITROUS OXID-OXYGEN ANALGESIA

C. HENRY DAVIS, M.D.

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Painless Childbirth
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Nitrous Oxid-Oxygen Analgesia

BY

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With tender memories of my
mother and her patience in suffering
this little book is dedicated
to
MOTHERHOOD

PREFACE TO SECOND EDITION

The early exhaustion of the first edition of this book is a good index of the interest which is now being manifested in better obstetrics. While painless childbirth is undoubtedly desirable, safe obstetrics is of fundamental importance. The wide publicity given "Twilight Sleep" has awakened a new interest in obstetrical problems. The average woman is beginning to realize that the greatest dangers in becoming a mother are due to the lack of proper care; that childbirth while a natural function of woman is not necessarily a purely physiological process; and that a physician must have both training and skill to meet successfully the emergencies which may arise either during pregnancy, labor or the puerperium. The average physician is beginning to realize that while he has been giving his

patients the care demanded by law, yet he has a moral responsibility beyond the average practices of the midwife.

In preparing these pages the writer has endeavored to give a brief, scientific, yet readable discussion of three very important subjects: Painless Childbirth, Eutocia and Nitrous Oxid-Oxygen Analgesia. Newspaper and magazine publicity has created a demand for Painless Childbirth. It is a problem which is of importance to every physician, whether he practices obstetrics or not, since at any time he may be asked to express an opinion on this subject even if only in the most general terms. In meeting this demand for the relief of pain, safety for mother and child must not be sacrificed. Eutocia is the goal for which obstetricians have been striving, yet conservative statistics indicate that obstetrics has made less advance in safety than any other branch of medicine, and that while

mortality and morbidity from nearly all diseased conditions have materially decreased in the past half century, yet maternity outside of the hospital is as dangerous today as it was before the discovery of anesthetics and antiseptics. Nitrous Oxid-Oxygen Analgesia during labor is not a new discovery, since it was used successfully in Europe in the early '80's and has been used to some extent in America for more than ten years. Although its value has been known for many years, the difficulties of administration and its supposedly excessive cost greatly limited its employment in mitigating the pains of labor.

More than a year has passed since Dr. J. Clarence Webster publicly announced the very satisfactory results obtained in the obstetrical work at the Presbyterian Hospital, Chicago, from the use of nitrous oxid and oxygen. Influenced by the papers from the members of our staff, together with the

papers from obstetricians in other cities, nitrous oxid-oxygen analgesia has been used extensively by physicians in all sections of this country. During the past year this analgesia has been employed in over 500 confinements in three Chicago hospitals, and at the present time is being used extensively in several others. It is of considerable significance that of all the obstetricians who have used nitrous oxid and oxygen long enough to develop their technic not one has questioned its value in the management of labor.

Prolonged self administration has been used extensively for more than six months. Several of the writer's patients have successfully administered their own analgesia for more than five hours. Patients are pleased that it is possible for them to do so much toward relieving their own suffering and are proud of their skill in using the automatic feed. It is rather an enjoyable

diversion during the hours of wakeful working. It may be continued in some cases until within a few minutes of delivery. My perfection of the technic for self administration has removed the time consuming objection to this method, and at present our patients require no greater care and watching than does the patient who has no analgesia.

There is now much evidence that the nitrous oxid-oxygen analgesia is the most satisfactory means yet employed for mitigating the pain of labor.

A new section giving the technic for administering nitrous oxid and oxygen analgesia and anesthesia in surgical procedures has been added to this edition.

CONTENTS

DEFINITIONS

Eutocia (u-to′-ke-ah) (εὖ well; τόκος, childbirth). An easy natural delivery. Eutocia should be the desire of every mother and the aim of every physician.

Analgesia (an-al-je′-ze-ah) (ἀ priv.; ἄλγος, pain). Insensibility to or absence of pain. In the use of nitrous oxid and oxygen the physician produces analgesia during the uterine contractions without interfering in any way with the normal mechanism of labor.

Amnesia (am-ne′-se-ah) (ἀμνησία, forgetfulness). Defect of memory. Loss of memory for words. The aim in *Dämmerschlaf* is to obliterate the memory of pain. During labors conducted under scopolamin and morphin or narcophin, the patients will often cry out as loudly during the uterine contraction and complain of as much pain as those who have no anesthetic, but in the successful cases they will not remember this after the delivery of the child.

PART I

PAINLESS CHILDBIRTH

The belief that pain is an inevitable accompaniment of labor has reconciled mothers to endure it, while the joy of successful motherhood has caused them to forget it. There is, however, no logical reason why women should suffer during labor.

PAINLESS CHILDBIRTH

CHAPTER I

Introduction

If labor is a purely physiological process it should be as free from pain as are other physiological processes. Yet if we are to believe the King James version of Genesis, Eve was undoubtedly the first woman to suffer the pangs of childbirth. Nevertheless there are many reasons for believing that the extreme suffering of labor is a penalty of civilization and artificial refinement.

Attempts to relieve the pains of labor date back to antiquity. Writing on the history of anesthetics in midwifery, Sir James Y. Simpson says: "The ancients appear also to have attempted to relieve the pain attendant upon parturition by anesthetizing agents, as we may learn from the

various Greek writers. Such a practice is mentioned by Platus in his *Ophelion,* and I may also quote the following passage. Theocritus says:

" 'For then the daughter of Antigone, weighed down with throes, called out for Lucina, the friend of women in travail, and she with kind favour stood by her, and in sooth poured down her whole limbs an insensibility to pain, and so a lively boy, like to his father, was born.' "

Further Simpson says: "In the trials of the sixteenth century we find many cases in which witches were prosecuted for attempting to abolish the pains of labor by charms and other means. One method that was practiced was to hold a sword before the patient, who was directed to look at it steadily, in the same way that Latona is said to have held a palm branch, and brought forth Apollo without suffering; an attempt at mesmerism in reality. Another

way employed was to hang the husband up in the next room by his feet till the labor was accomplished."

Yet it is evident that there was very little attention given the suffering of the expectant mother before the experiments of James Y. Simpson, who was knighted by Queen Victoria after she had experienced painless childbirth. When in 1847 he introduced ether and chloroform into obstetrical practice there was a storm of disapproval. Had it been in the sixteenth century there is little doubt but that he would have fared as badly as the witches. Since God had in his primeval curse said: "In sorrow thou shalt bring forth children," the religious fanatics, and they were many in his day, claimed that it was sacrilegious to relieve the pangs of childbirth. But Simpson was able to prove by the Bible that God had promised on several occasions to remove the curse. Furthermore he argues

that if: "we were to admit that woman was as a result of the primal curse, adjudged to the miseries of pure physical pain and agony in parturition, still, certainly under the Christian dispensation, the moral necessity of undergoing such anguish has ceased and terminated."

The Labor of Primitive Races

Much has been said of the painless labors of the primitive races. In the diary of the Lewis and Clarke expedition under the date of August 26, 1805, we find this interesting record:

"One of the women, who had been leading two of our pack horses, halted at a rivulet about a mile behind, and sent on the two horses by a female friend. On inquiring of Cameahwait the cause of her detention, he answered, with apparent unconcern, that she had just stopped to lie in, but would soon overtake us. In fact,

we were astonished to see her, in about an hour's time, come on with her new born infant, and pass us on her way to the camp, seemingly in perfect health. The wonderful facility with which the Indian women give birth to their children would seem some benevolent gift of nature, in exempting them from the pains which their savage state would render doubly grievous."

Engleman tells us that: "Commonly labor is conducted most privately and quietly; the Indian squaw is wont to steal off into the woods for her confinement. Alone or accompanied by a female relative or friend she leaves the village, as she feels the approach of labor, to some retired spot; upon the banks of a stream is the favorite spot the world over. The vicinity of water, moving water if possible, is sought, so that the young mother can bathe herself and her child and return to the village cleansed and purified when all is over." But while

the labor of the primitive woman was usually easy and relatively painless, in the presence of some pathological condition her agonies often ended in death.

The Penalty of Civilization

Civilization with its artificial dress and customs has rendered woman more of a hot-house product and physically less fit to perpetuate the race. Thirty years ago Lusk warned us that: "As the nervous organization loses in the power of resistance as the results of higher civilization and artificial refinement, it becomes imperatively necessary for the physician to guard her from the dangers of excessive and too prolonged suffering."

Among civilized women easy and painless childbirth is not rare, but most women are in labor several hours, and unaided endure considerable and often very severe pain. The belief that pain is an inevitable

accompaniment of labor has reconciled mothers to endure it, while the joy of successful motherhood has caused them to forget it. There is, however, no logical reason why women should suffer during labor. Surgeons will not permit their patients to suffer during an operation. Suffering, physical or mental, produces surgical shock; it increases the danger of puerperal complications, and delays the convalescence. The suffering can be relieved and with perfect safety to both mother and child.

CHAPTER II

Development of Anesthetics

The development of anesthetics is an interesting chapter in the history of medicine. Sir Humphrey Davy, in 1800, discovered the anesthetic properties of nitrous oxid, and suggested its employment in surgery in the following words: "As nitrous oxid, in its extensive operation, seems capable of destroying physical pain, it may probably be used to advantage during surgical operations in which no great effusion of blood takes place." In 1818, Faraday showed that the inhalation of ether vapor produced anesthetic effects similar to those of nitrous oxid. Crawford W. Long of Georgia, in 1842, used ether to produce anesthesia during surgical operations. Two

years later, Horace Wells had a tooth extracted while under the influence of nitrous oxid. Morton used ether for surgical anesthesia in the Massachusetts General Hospital in 1846, and made the first public announcement of its use for this purpose. In January, 1847, Simpson first used ether to produce analgesia in midwifery. Flourens, in March of the same year, announced the anesthetic properties of chloroform, and Simpson, in November, read his paper entitled, "Notice of a New Anesthetic Agent as a Substitute for Sulphuric Ether in Surgery and Midwifery." From this time there was a rapid development of chloroform anesthesia, while after the death of Wells little use was made of nitrous oxid until after Edmund Andrews, in 1868, suggested its use with oxygen. Ten years later Paul Bèrt conducted exhaustive experiments to show the safety of nitrous oxid and oxygen as an anesthetic.

Development of Obstetrical Analgesia

Ether and chloroform were in turn advocated by Simpson, and, since his experiments, have been used to some extent by every physician who has practiced obstetrics. Following its use by the late Queen Victoria, chloroform *a la rèine* became the fashion and analgesia was maintained for many hours in large numbers of cases. Protheroe Smith, in a letter to Simpson, states that he had used the chloroform analgesia for as long as twenty-eight and one-half hours. Simpson, himself, used it for over thirteen hours. But recent experiments have demonstrated the dangers of these anesthetics, and, while chloroform has been discarded by many obstetricians, ether has been limited to the end of the second stage of labor, and therefore only partially relieves the suffering.

Klikowitsch of Petrograd applied nitrous

oxid-oxygen analgesia to twenty-five obstetrical cases in 1880. He used 80 per cent nitrous oxid and 20 per cent oxygen, and observed that three or four inhalations rendered the uterine contractions painless without clouding the consciousness. He reported that the uterine contractions were often stimulated and that in no case was there any diminution in their frequency or strength. The following year Winckel of Dresden used the nitrous oxid-oxygen analgesia in 50 cases, and in his Text-Book of Midwifery (translated by Edgar) makes the following statement:

"Narcosis by means of laughing gas is not dangerous and may be discontinued at the will of the parturient woman; it mitigates the pain in proportion to the intelligence of the person, as stupid persons often withstand its influence for a long time before its favorable effect is felt. In most persons its inhalation produces a state

of intoxication for a short time with a tendency to laughter. Women to whom it is not administered until the stage of expulsion, can seldom be induced to inhale it quietly, while when it is administered in the first stage of labor its beneficial action is at once felt and extends to the second stage. It is especially useful in primipara."

In speaking of the clinical results Winckel says:

"The pulse of the parturient woman is usually slowed considerably by laughing gas, but finally reaches its original rate again. The child's pulse is also slower in 8 per cent, but usually it seems to be more frequent. The woman's temperature rises often several tenths of a degree. At first the pupils are somewhat contracted. The pains are not the same in strength or duration, but are often more frequent and stronger, and existing vomiting frequently ceases. Klikowitsch and I have both ob-

served aphasia, and once in 50 cases a hystero-epileptic attack was caused, and in one a real epileptic seizure followed its use, but otherwise no bad effects were observed, either as regards the mother or the child. The oxygen of the blood remains in normal combination, while the nitrous oxid probably circulates in much looser chemical combination in the blood, absorbed by the plasma. (Doederlein.) These researches should be supplemented by the observations of others, and were by no means thought conclusive by us, as Doederlein believes. It seems to me most practical to get the mixture from the apothecary, as was formerly the case, and that he should be provided with rubber bags, which he may fill and furnish the physician when needed. In this manner the gas might be introduced into private practice and would not be monopolized by the clinics. A number of interesting problems attach to its use, but we

refrain from discussing them. The apparatus which consists of a rubber bag like a pillow, is inconvenient, it must be confessed, but this is entirely subordinate; in abnormally painful labor it is at any rate an extremely important remedy."

But owing to its cost, the impurity of the gas secured, the crudeness of the apparatus used, and the fact that it was often given to the stage of asphyxia, nitrous oxid did not come into use at that time.

In 1902, von Steinbüchel of Gratz first suggested the use of scopolamin and morphin analgesia in obstetrics, and the following year reported its use in twenty cases with only one in which the pain was not relieved. Gauss of Freiburg made his first report in 1906. The method has been tried by many physicians with varying degrees of success, but due to the long continued experiments of Gauss a technic has been developed, which, under favorable condi-

tions and in selected cases, gives satisfactory results in from 70 to 90 per cent of the cases in which the drugs are administered. After some twelve years of use, abuse and disuse, the use of scopolamin and morphin was discovered by the lay press, and the women of America were told of this wonderful (?) *Dämmerschlaf* and painless childbirth. Within a few months "twilight sleep" became a fad, and the relief of pain during labor became the chief problem of the average physician who practices obstetrics.

CHAPTER III

The Chemicals and Their Effects

While we believe that the early development of the woman, her general condition of health, her pre-natal care with its diet and exercise, are of prime importance in securing eutocia, there are at present two important methods of relieving the pain of labor. But before discussing their relative merits in obstetrical practice, it will be well to consider the chemistry, physiology and pharmacology, and the toxicology of the chemicals used.

Chemistry

Nitrous oxid is a colorless, odorless gas having a somewhat sweetish taste, which was discovered by Priestly in 1772. It is

obtained from the distillation of ammonium nitrate.

Oxygen is a gaseous element which was also discovered by Priestly in 1774. It "is a permanently elastic fluid, invisable, inodorous, and a little heavier than atmospheric air."

Morphin is the chief alkaloid of opium and represents its physiological activity.

Scopolamin is obtained from the dried rhizome of Scopola Carniolica, and hyocin is an alkaloid derived from the leaves and flowering tops of Hyocyamus Niger. They are identical in their chemical formulæ and have the same physiological action. (Stevens.) It is stated that many manufacturing chemists dispense both from the same stock bottles.

Physiology and Pharmacology

Cushny states that nitrous oxid supports combustion outside the body, but that so

far as the metabolism of protoplasm is concerned, it behaves the same as any other indifferent gas, since the oxygen is not split off from the nitrogen as it is when the oxid is exposed to high temperatures outside the body. "Nitrous oxid is dissolved in the blood exactly as in water. There is no chemical combination formed with any of its constituents, nor is the hemoglobin altered in any respect." He considers that the nitrous oxid has a direct effect on the central nervous system, although it is indifferent to other tissues. But, "Bert's and Martin's experiments would indicate that death occurs not from the direct action of the oxid on the respiratory center, but from the lack of oxygen, although the depression of the center is undoubtedly a contributing factor." (*Cushny, Textbook on Pharmacology, 1906.*)

"Oxygen gas is necessary to respiration, and no animal can live in an atmosphere

which does not contain a certain proportion of uncombined oxygen."

Cushny says that the action of morphin on the central nervous system seems to consist of a mixture of stimulation and depression. In man and most other animals the respiration is slowed by morphin. Children are very susceptible to opiates. Morphin has little direct action on the circulation. As a general rule the secretory glands are rendered less active. The selective action of morphin is illustrated in its effects on the medulla oblongata, for the respiratory centre is paralyzed before the centres for cardiac inhibition and vasoconstriction are affected to any marked extent.

In large doses scopolamin paralyzes the inhibitory terminations in the heart, but in therapeutic doses this effect is not observed. As a general rule hyocin produces a marked sensation of fatigue and drowsiness, and

the patient moves about less and speaks less. "Larger doses do not cause deeper sleep but give rise to delirium and excitement resembling those following atropin. In one or two cases collapse has been observed from the use of scopolamin. The vaso-motor and respiratory centres do not seem to be stimulated as by atropin, the blood-pressure falling and the respiration becoming slower from the beginning." (Cushny.)

H. G. Barbour found in his recent experiments that morphin and scopolamin did not inhibit the activity of the uterus in cats. He believes that the delay in labor produced by either or both of these drugs is probably due entirely to their cerebral action. (*The Journal of Pharm. and Exp. Thera., 1915,* VII, *547.*)

Barbour and Copenhaver in their experiments with scopolamin and morphin on the pregnant and non-pregnant uterus of

guinea pig and cat did not observe the inhibitory action upon the tone of the uterus described by Kehrer for large doses. They found that very high concentrations of either tend to produce a tetanic condition of the uterus. (*The Journal of Pharm. and Exp. Thera., 1915,* VII, *529.*)

Toxicology

Gwathmey states that: "When nitrous oxid is given pure or alone, death is always due to oxygen deprivation and asphyxia. The heart continues to beat after respiration has ceased, which proves that death is not due to failure of circulation."

Hewitt was able to find thirty deaths occurring during the administration of nitrous oxid, reported in the literature prior to 1901. At least fifteen of these were due to asphyxia with nitrous oxid. A few deaths have occurred during the administration of nitrous oxid and oxygen as an anesthetic, but always in cases which

would undoubtedly have died under any anesthetic, or from asphyxia due to some interference with the proper flow of oxygen during the use of some complicated apparatus by an inexperienced anesthetist.

Tanner warns us that: "It must not be forgotten that not a few individuals are unable to take even one-third of a grain (opium) without becoming narcotized. Young children are particularly susceptible to its effects; the tenth and twelfth parts of a grain having proved fatal to infants two and five days old; and there is recorded the case of an infant seven days old who died comatose eighteen hours after having had administered to it the twelfth of a grain opium or the quantity contained in a drop of laudanum." (*Tanner, Memoranda on Poisons.*)

Scopolamin alone has never been the cause of death, but Stevens warns us that: "As scopolamin and morphin, however, are

not, as was formerly supposed, antagonistic in their action on respiration, considerable caution should be exercised in using them conjointly in such large doses." (*Materia Medica and Therapeutics, P. 77.*)

M. I. Smith found that the toxicity of the scopolamin-morphin combination in the mouse is increased with the relative increase of the scopolamin content of the combined dose. (*The Journal of Pharm. and Exp. Thera., 1915,* VII, *407.*)

The above comparative study of the chemicals used in the nitrous oxid-oxygen analgesia and in the *Dämmerschlaf,* shows that while the first does not appear to interfere with the normal physiological processes and is free from all danger so long as a proper amount of oxygen is given, the second group of drugs even in small doses do interfere with normal physiological processes and that children are very susceptible to even very small doses.

Comparative Safety of Anesthetics

In speaking of the comparative safety of anesthetics, Louis Frank says: "Available statistics show that the average mortality from chloroform is one in 3000, whereas, that of ether is one in about 30,000 administrations. The action of both drugs is through absorption by the lipoids; both produce lower blood pressure, both produce marked depression; in other words, their administration is accompanied with manifestations identical with those recognized as due to shock. . . . The comparative safety of nitrous oxid was demonstrated by the researches of Buchanan, who found after a careful study of statistics covering many millions of inhalations of this gas that the mortality was probably about one in 5,250,000 administrations." (*American Journal of Obstetrics, N. Y., 1915,* LXXI, *630.*) However, from a large experience

with nitrous oxid, I doubt it being this safe if given to the stage of anesthesia by the average physician, and consider as more probable the statement of Miller, who says: "The statistics of nitrous oxid vary from one death in 100,000 to one in 750,000 cases." (*Journal of the American Medical Association, 1912,* LIX, *1847.*)

In his report on the use of scopolamin and morphin in surgery and obstetrics, Hatcher says: "H. C. Wood Jr. studied the cause of death in 23 cases in which scopolamin and morphin had been used, and he concluded that at least 9 of these deaths must be attributed to the scopolamin and morphin, the death rate being one to 250 narcoses." . . . In speaking of its use in obstetrics he says of the *Dämmerschlaf* ("Twilight Sleep"): "It is one of the cardinal principles of medicine to avoid the use of narcotics, and particularly morphin with infants, and it is difficult to

believe that its use is wholly devoid of injurious actions." (*Journal of the American Medical Association, 1910,* LIV, *516.*)

CHAPTER IV

Nitrous Oxid and Oxygen in American Obstetrics

Dr. J. Clarence Webster of Chicago was one of the first in America, if not the first, to use nitrous oxid and oxygen in obstetrical practice. About ten years ago he began to use this anesthetic in operative obstetrics when the use of ether and chloroform were contraindicated, and gradually extended its use to all types of cases. (*Jour. A. M. A., 1915,* LXIV, *812.*) In 1909 the writer gave the anesthetic for Dr. Webster when he performed the first Cesarean section operation under nitrous oxid and oxygen. During that year we gave this anesthetic for all types of operative obstetrics, and in one primipara gave the gas for about two hours prior to a for-

ceps delivery. (*Jour. A. M. A., 1915,* LXV, *992.*) Although at that time we appreciated the value of nitrous oxid and oxygen in obstetrical practice, its use was limited to the end of the second stage of labor as the hospital was not willing to bear the supposedly excessive cost of its prolonged administration. Arthur Guedel of Indianapolis in 1911 advocated the use of nitrous oxid-air analgesia during the second stage of labor. (*Indianapolis Med. Jour., Oct., 1911.*) (*Jour. Ind. State Med. Ass'n., March, 1915.*) But our first knowledge of its prolonged use in America was in July, 1913, when Drs. Lynch and Hoag confined the daughter of a Mr. Clark, the maker of a gas machine. Dr. Lynch says that Mr. Clark "sought at his own risk to try in his family the method which his demonstrators were teaching for dentistry." The analgesia was maintained for over five hours. Dr. Lynch was very enthusiastic

over the results obtained and since then has been a constant user of the analgesia. The other members of our obstetrical staff, Drs. N. S. Heaney and Carey Culbertson, are equally enthusiastic.

During the past two years nitrous oxid-oxygen analgesia has been used by Chicago obstetricians in several hundred cases. In nearly every case a few deep inhalations of the gas has relieved the severity of the contraction. In no case has the labor been delayed, but rather it has been hastened because of better assistance on the part of the mother. The duration of labor is apparently shortened about 25 per cent. by the nitrous oxid analgesia. It gives an increased control over the patient and there are none of the hysterical outbursts formerly occurring in the delivery room. No longer are the patients in the other parts of the hospital disturbed by the outcries of the expectant mothers. The babies cry as quickly

after the use of the analgesia as when no anesthetic is given.

The actual cost of the nitrous oxid and oxygen for the ordinary obstetrical case is small, the prevention of suffering and shock is invaluable. The longest over which I have had to administer the analgesia was nearly eleven hours, in a primipara with a contracted pelvis of moderate degree and a dry labor. The cost of the gas used in this case was six dollars. With multipara it is rarely necessary to administer the analgesia longer than two hours. In primipara the labor is usually terminated within three hours from the beginning of the painful contractions.

In maintaining analgesia the confidence and cooperation of the patient is necessary. The more intelligent the patient, the easier it is to obtain satisfactory results.

CHAPTER V

Objections to "Twilight Sleep"

The so-called "Twilight Sleep" or *Dämmerschlaf* has been used in several thousand cases, and in the hands of the most skilled the results have been fairly satisfactory in from 80 to 90 per cent of the cases. However, the use of the scopolamin and morphin narcosis in surgery is known to be far more dangerous for the average case than any other anesthetic. The susceptibility of infants and certain adults to opium or its alkaloids cannot be questioned. We know that the infant in utero may absorb enough of the narcotic to render resuscitation difficult and that at times the infant has died.

Those who have had the largest experience with scopolamin and morphin or nar-

cophin in obstetrical practice are agreed that this method should be used only by the obstetrical specialist; it should be used only in a specially equipped delivery room which is protected from all noise and confusion; the physician must be in constant attendance; a large experience in the use of the drugs is necessary; the action of the scopolamin and morphin is uncertain; the patients are at times very hard to control; and failures are to be expected in 10 per cent or more of the cases subjected to the treatment.

Dr. Webster says: "In spite of the publicity which has been given this so-called 'Twilight Sleep' method by the lay press it has not found favor with the majority of the leading obstetric authorities in Europe or America. They are too well aware of the uncertain effects produced by the mixture and of the complications which may be caused, to adopt it. For many

generations obstetricians have avoided the use of morphin, except in rare cases, because of its bad effect on the child and its interference with the muscular activity in the mother. Scopolamin is variable and uncertain in its action and very often produces marked excitement in the woman, which may greatly interfere with the carrying out of a clean technic. The lay press has not referred to the mental disturbances which have been produced nor have they made known that in that part of Germany where the procedure originated, a large number of damage suits have been instituted in the courts against prominent physicians, because of various ill effects alleged to be due to 'Twilight Sleep.'" (*Jour. A. M. A., 1915,* LXIV, *812.*)

In discussing "Twilight Sleep," or the semi-narcosis of scopolamin and morphin, Dr. F. W. Lynch has well said:

"From the standpoint of pure theory, the

method presents many faults. The procedure is theoretically perfect for the first stage, yet the first stage is usually neither dangerous or difficult to withstand. Heart cases, pneumonias, typhoids and toxemias pass safely through it, to meet trouble in the second stage. Were relief from pain possible in but one of these two stages, there is no doubt but that the second would be selected for such protection. Yet the failures of the seminarcosis occur during this period. The second stage is prolonged and distorted from the normal picture. It commonly requires augmentation or artificial delivery. There is considerable danger to the child at this time. Proper asepsis is often impossible. Nor is the method ideal in its action. There is the objection common to all medicines, that a drug once given by the hypodermic is beyond recall, although this is controlled to some degree by the rapid excretion. Yet the drug

utterly fails to protect the brain. Sensory perceptions are not markedly inhibited in the proper doses of the method. The patient complains of pain and reacts to it as much as the motor incoordination will permit. Sensory perceptions are diminished by shading the lights, stopping the ears with cotton, and giving smoked glasses for the eyes, and restricting sounds and noises as much as possible. Yet stimulation of pain reaches the brain. The drugs cause motor incoordination rather than a checking of sensory impressions. To all intents and purposes the patient is drunk. Thus the alcoholic receives sensory impressions, but presents motor incoordination. He argues, and complains, and wakes the following morning with utter forgetfulness of the events of the recent past. He, too, has amnesia. Cases have been reported which have been delivered painlessly during alcoholic drunkenness, or else remembered no

pain. Rush, years ago, cited the case recorded by Church, Allright that of Daneux, etc." (*Ill. Med. Jour., 1915,* XXVII, *257.*)

CHAPTER VI

Advantages of Nitrous Oxid-Oxygen Analgesia

Nitrous oxid and oxygen is conceded to be the safest of anesthetics. Nitrous oxid can only cause death from asphyxia, and in giving the analgesia this is impossible owing to the use of oxygen and the few inhalations required. It is quickly eliminated and has no bad effects on the mother or child. In no case will the analgesia lengthen labor, but rather will shorten it because of better assistance on the part of the mother. It is easier to carry a hypodermic needle than a gas machine; but while the "Freiburg Method" should be used only by the specialist, *the nitrous oxid-oxygen analgesia may be used safely and efficiently*

by every physician who is trained in the science of obstetrics. It can be administered as safely in the home as in the hospital. (It is not admitted that an obstetrical case is as safe in the home as in the maternity hospital.) It may be used in all classes of cases, the results varying with the cooperation of the patient and the skill of the obstetrician. It gives an increased control over the patient in that there are none of the hysterical outbursts formerly occurring in the delivery room. *Neither Dämmerschlaf nor nitrous oxid-oxygen analgesia can take the place of clean, scientific obstetrics, but with the demand of women for the relief of labor pains, will come an increased intelligence regarding childbirth, and better obstetrics must result.*

In an alternating series of cases at a Brooklyn Hospital, Allen observed that the

women under the scopolamin and morphin were in labor longer and did not feel as well afterwards as the women who had the nitrous oxid-oxygen analgesia. (*N. A. Jour. of Hom., 1914,* XXIX, *Nov.*)

It may be better to give the "Twilight Sleep" than to let the woman suffer intensely, but drugs act differently; people have their idiosyncrasies; the hypodermic injection of the scopolamin and morphin is beyond recall. We concede that the suffering of labor may be relieved with the prolonged administration of ether or chloroform, but the reports from large clinics and from laboratory investigators show that these anesthetics are not free from danger and that they must be used with great care. On the other hand, in the use of the nitrous oxid-oxygen analgesia we have eutocia without danger to mother or child. The nitrous oxid-oxygen analgesia,

being safe and certain, is the logical method of relieving the pangs of childbirth. It is a method which does not interfere with an aseptic technic.

PART II

EUTOCIA

Suffering during labor is but the tide in the ocean of motherhood, and the desire of mothers is eutocia—not amnesia.

CHAPTER VII

Eutocia

It is the right of woman to demand relief from the pains of childbirth, and it is the duty of the physician to relieve her of these pains in the same spirit that he relieves other suffering. The pain of labor causes shock and is, I believe, more dangerous than the proper use of any of the analgesics now employed. Yet it is the duty and should be the aim of every physician to employ the safest and best measures in the care of his patients.

Physicians complain that they cannot give their patients better obstetrical care because of the ridiculously low fees, and it is a fact that people do pay several times as much for an appendectomy as for a con-

finement. The American public, including many physicians, must learn that training, cleanliness and adequate facilities are as necessary for the confinement as for the surgical operation. For the physician with a surgical training, the appendectomy, when difficult, is still a more simple procedure than the difficult obstetrical operation; it requires no greater skill and less experience. In the obstetrical procedure two lives are often in the balance.

Major surgery has become relatively safe because of the surgical specialist and the adequate facilities of the modern hospital. The internal medicine specialist and the general practitioner take their patients to the hospital for medical treatment because experience shows that hospital treatment insures a better prognosis.

We honor the mother above all other women. We set aside one Sunday each year to voice her praises. If she develops

tuberculosis, she is sent to a sanitorium for treatment. If she has a tumor, she is sent to the hospital for an operation. If she has arthritis, pneumonia, typhoid fever, or gastric ulcer, she is sent to the hospital because it betters her chances for life and health. But for the crowning event of her life—motherhood—there is no adequate provision. Our hospitals have a few beds for operative cases, but the great mass of women must of necessity be delivered at home. More than half of the women in our large cities are still confined by ignorant and, too often, filthy midwives.

It is a disgrace to the American people that during the past half century there has been no decrease in obstetrical mortality and morbidity outside of the hospitals. It is a disgrace to the medical profession that, after carefully investigating the midwife problem for the American Medical Association, Professor J. W. Williams was

forced to say: "Ordinary practitioners lose proportionately as many women from puerperal infections as do midwives." And "more deaths occur each year from operations improperly performed by practitioners than from infection in the hands of midwives." Williams urges: "Education of the laity that poorly trained doctors are dangerous, that most of the ills of women result from poor obstetrics, and that poor women in fairly well conducted free hospitals usually receive better care than well-to-do women in their own homes; that the remedy lies in their own hands and that competent obstetricians will be forthcoming as soon as they are demanded." (*Jour. A. M. A., 1912,* LVIII, *1.*)

It is a disgrace to the hospital boards that, while they are providing so many beautiful hospitals with thousands of beds for the medical and surgical treatment of men, women and children, they have only

a few beds for maternity cases. It reflects on their financial judgment to give so many free beds for the medical and surgical treatment of conditions which proper obstetrical care would have prevented.

How much longer are the mothers who suffer from unnecessary ills going to suffer in silence? Are the husbands who bear the burdens of the unnecessary invalidism going to do so forever and make no effort to secure safer obstetrics? Are the mothers who are more or less invalided because of poor obstetrics and lack of proper facilities going to allow their daughters to grow into motherhood and, with open eyes, endure the same unnecessary suffering?

Women writers, woman's clubs, and the "Twilight Sleep" Association are urging the German *Dämmerschlaf* as a means of securing painless childbirth. Important as painless childbirth may be, it is only one wave in the sea of obstetrical problems. The time

has come when women must take a few hours from the church, the club and politics to protect motherhood by demanding that maternity be given its proper place in modern preventive medicine. *Let them learn that obstetrical accidents will sometimes happen in the hands of the most skilled, but that the large percentage of the bad results are due to ignorance and lack of surgical cleanliness; that most of the ills following childbirth are due to poor obstetrics and are unnecessary, and they will then demand the same skilled care in childbed that they demand when they undergo a surgical operation.*

The chief dangers of maternity can be eliminated by proper pre-natal care and confinements conducted in a clean and scientific manner in properly equipped hospitals. In relieving the pain of labor competent physicians must use the method safest for both mother and child. Suffering

during labor is but the tide in the ocean of motherhood and the desire of mothers is eutocia,—not amnesia.

CHAPTER VIII

Obstetrical Facts and Comparative Statistics

In the preceding pages several statements were made which will to the average mind seem farfetched. To believe that the obstetrical mortality of today is as great as it was before the discovery of anesthesia and antiseptics, is difficult unless one is confronted with facts. It is probable that very few physicians realize that with the great progress of preventive medicine and aseptic surgery that there has not been a similar increase in the safety of maternity. The responsibility for the present high mortality cannot be laid at the door of the midwife, for physicians confine a far greater percentage of the women today than a half century ago.

By means of liberal quotations from the writings of obstetrical authorities, together with mortality statistics of the several countries the author has hoped to arouse the reader to realize the great need of better, safer obstetrics.

The mortality records of the United States show that there are only two and one-half times as many women of child-bearing ages who die from tuberculosis as die each year from puerperal sepsis and other obstetrical complications, and when we consider that not more than one woman in fifteen of the female population between 15 and 45 is delivered of a full-term child during the year the awfulness of existing conditions becomes more apparent.

De Lee says of puerperal sepsis: "It kills one in four hundred women delivered of full term children; it leaves as incurable invalids at least ten times this number." (*De Lee: "Obstetrics," p. 872.*)

That puerperal sepsis may be largely eliminated is shown by the records of the large maternity hospitals and by the experience of trained obstetricians. Obstetrical operations should be relatively safe, but the haphazard use of the obstetrical forceps and other operative procedures has apparently prevented a lowering of the operative mortality.

While 5,131 babies died from injuries at birth, 27,359 from premature birth, and 20,375 from congenital debility (?) in the registration area during 1913, this vast loss will not be discussed since better obstetrics means a great lowering of the infant mortality. The registration area comprised 65.1 per cent of our population, or 63,298,718 people.

Our laws may be responsible to some degree for present conditions, but as Judge Lindsay has said: "Law is beneficial to society just in proportion to the degree

it is sustained and influenced by public opinion and influenced through the pressure of public opinion."

Haultain, discussing this subject, quotes from the writings of Champneys, who says:

"Up till 1900 there was an increasing number of deaths from sepsis, since then it has decidedly dropped. To the adoption of the Midwives Act this may fairly be said to be due, the majority of mothers being now attended by women educated in the principles of cleanliness and antisepsis.

"In 1902, when this act came into force, the death rate from puerperal sepsis per million women was 118.

"In 1907 it fell to 81. As the 1901 census shows the number of women in England and Wales to be 16,800,000, the fall of 37 per million means that, without estimating actual increase in the number of women, 621 women were saved from this disease

alone who would have died in 1902." (*Haultain, Trans. Edin. Obs. Soc. 1910-11,* XXXVI, *15.*)

Addressing the Edinburg Obstetrical Society in November, 1900, R. Milne Murray said:

"We stand today 'the heirs of the ages,' and in virtue of the labors of those who have gone before us, we claim that for every strictly obstetrical complication which can arise, with only perhaps one exception, we have at our disposal a procedure with which we can meet it; that, in fact, there is scarcely a peril which can beset a woman in travail, out of which we have not the means of rescuing her. Of course I speak of strictly obstetrical complications. There are accidental diseases, such as grave disorders of the nutritive apparatus, of the heart, lungs, kidneys, etc., which produce conditions with which obstetric medicine is at present powerless to deal.

"But for all else (save perhaps eclampsia) we profess a remedy, provided always we are entrusted with the care of the patient in reasonable time. Malpresentation, malposition, deformed pelvis, of whatever degree, hemorrhage of whatever sort, rupture of the uterus, each and all have their appropriate treatment which has been tested times and times again, and has stood the test with unqualified success. This, then, is the profession, and the reasonable profession made by the obstetrician today, armed as he should be with an accurate knowledge of obstetrics, and with anesthetics and the technic of antiseptic surgery.

"Surely, then, the trees of the Arician Grove are dead and withered, for no woman now need come to the shrine of the goddess; and surely also the Litany for 'all women laboring of child' is obsolete and forgotten. Alas! it is not so, for the trees of the grove are green as ever, and the altar of the

goddess is laden with offerings, and the Litany goes up each day from trembling lips and sinking hearts; for each year, in our land alone, nearly 5,000 women fall and perish in the perils of childbed.

"Where now is our proud boast? What are we to say for modern midwifery when we witness year by year this sacrifice of fifty hecatombs of the most precious lives in the whole community, most of them in the very prime of life, many of them already the mothers of helpless children? Are we to fall back on the council of despair and declare this to be the irreducible minimum? Surely by all that is reasonable, NO!

"Let us look at the facts a little more closely. Between the years 1847 and 1856, the average annual death rate from puerperal fever was 1.89 per 1,000. During these years chloroform was coming into use, but was by no means generally employed,

and antiseptics had scarcely been thought of.

"Between the years 1875 and 1884 the mortality from the same cause rose to 2.28 per 1,000. By this time anesthetics were in wide use and antiseptic methods had been taught and practiced to a very great extent.

"Between the years 1886 and 1895 the mortality had now risen to 2.46 per 1,000. During this time anesthetics and antisepsis may be supposed to have been almost universally practiced."

But contrasted with these statistics regarding the general mortality from puerperal sepsis are those from the maternity hospitals which before the use of antiseptics were veritable morgues. In speaking of this change J. Halliday Croom (*Trans. Edinburg Obstetrical Society, vol.* XIII) says:

"Everyone knows that at one time a

mortality of 15 to 20 per cent was by no means uncommon. Will anyone dare to say that antiseptics have not entirely and absolutely revolutionized this? How else can we explain the recent history of such hospitals as those in Paris, Prague, Copenhagen, London, and Edinburg, where, as a matter of fact, the disease has been practically stamped out. I doubt if there is a more striking practical fact in the whole history of medicine than that in the hospitals I have just mentioned, when, without any external or internal change in the hospitals except the introduction of antiseptics, the mortality should have fallen from 20 per cent to almost *nil.*"

De Lee, in his "Obstetrics" (p. 871), says that "in Germany about 5,000 women are lost each year from infection, and fully as many more from accidents of childbirth." He quotes from Von Herff, who recently called attention to a slight but persistent—

and deplorable rising of the mortality from sepsis, which he ascribes to the lack of aseptic practice *by the physicians* and the increase of obstetric operating.

"Von Herff, in 1906, reported in Basil, up to that date, 6,000 cases had been delivered without a single death (from sepsis). Lea quotes Ahlfeld, Marburg, as having had 8,000 cases with one death, the infection having been acquired in the hospital, but the patient had examined herself. In the Rotunda Maternity, Dublin, 2,060 women were delivered without mortality from infection caused in the hospital, and Dr. Broxall gives the record of York Road Lying-in Hospital, with 8,373 deliveries without death from infection, ascribable to the hospital care." (De Lee.)

CHAPTER IX

Unnecessary Mortality

We are all familiar with the ravages of tuberculosis and cancer. During the past few years there has been a splendid effort to control the white plague. The results show that the effort was not in vain. Cancer has now come to be the dread disease of the country and much time and money is being spent in the effort to discover its cause and to educate the people to the need of an early diagnosis and operation. But the mortality records in the United States indicate that there has been no lessening in the dangers of maternity during the time vital statistics have been recorded.

A study of the mortality statistics from the area of registration in the United States for the year 1913, shows that 26,265

women between 15 and 45 years of age died of tuberculosis, and 5,065 from cancer. During the same period 4,542 died from puerperal sepsis and 5,468 from other obstetrical accidents.

It is unfortunate that in computing the mortality statistics for puerperal sepsis the government reports give the deaths per 100,000 for the entire population when only a few of the total population bear children. Because of this fact the enormous maternal mortality has not been apparent when compared with the statistics for tuberculosis and cancer. Yet it is seen that nearly as many women of childbearing age die yearly from puerperal sepsis as do from cancer, and maternity is responsible for twice as many deaths each year as is cancer. It is also evident that for every six deaths from tuberculosis among women between 15 and 45, one dies from puerperal sepsis. While there

are two and one-half times as many women of the childbearing age die from tuberculosis as do from sepsis and other obstetrical complications, it must be remembered that only 53.4 per cent of the women between 15 and 45 are married and that of the married women not more than one in eight will have children any one year. Without giving figures it is evident that maternity is a greater danger to our women than is tuberculosis.

If puerperal infection kills 1 in 400 women delivered of full-term children, it kills 250 in every 100,000 deliveries. The mortality statistics in the registration area of the United States for 1913, shows that per 100,000 population that 78.9 died of cancer; 127.7 from pulmonary tuberculosis; 8.7 from scarlet fever; 18.8 from diphtheria and croup; 12.8 from measles; and 17.9 from typhoid fever. These statistics give puerperal sepsis as 7.2 and other puerperal

accidents as 8.6 per 100,000 population. These statistics indicate that there is twice as much danger of the pregnant woman dying from puerperal sepsis as there is of the average woman dying from tuberculosis. *On the other hand statistics show that puerperal sepsis has in well regulated maternity hospitals been reduced to almost nil.*

With all the advancement in the science of obstetrics, in this age of low surgical mortality and preventive medicine, why is maternity so dangerous? Why has there been a slight increase in the number of deaths from puerperal sepsis and other obstetrical complications since the discovery of anesthetics and antisepsis? Milne Murray answered this when he said:

"I feel sure that an explanation of much of the increase of maternal mortality from 1847 onward will be found in, first, *the misuse of anesthesia,* and second, *in the ridiculous parody which, in many practi-*

tioners' hands, stands for the use of antiseptics. In a word, the use which has been made by many of two of the greatest blessings of humanity has converted them into little else than a curse. Before the days of anesthesia interference was limited and obstetric operations were at a minimum, because interference of all kinds increased the conscious suffering of the patient. Thus forceps and turning were employed when natural efforts had failed, and such operations as the artificial dilatation of a rigid os were not attempted until it became an urgent necessity. When anesthesia became possible and interference became more frequent, because it involved no additional suffering, operations were undertaken when really unnecessary on the demand of the patient or for the convenience of the practitioner. And so complications arose and the dangers of labor increased. But the

knowledge that this interference involved risks must have served as a salutary check to some extent. I doubt not that a split cervix, followed by a fatal hemorrhage or a death from puerperal sepsis must have burned its lesson into more than one reflective conscience in these days.

"Then came the antiseptic era. Here was now the panacea for all the dangers of childbed. All that was necessary was to dip the instruments for a few minutes in a carbolic lotion, and the hands in one of half the strength for half the time, and all the danger was at an end. The forceps were passed through an undilated os; if it tore slightly, no matter, the antiseptic made that quite safe. Turning was now a matter of mere manipulative skill—a clean hand in the uterus could do no harm. This is no mere caricature: and if it represents the methods of any reasonable proportion

of practitioners what wonder the cup was so often filled with death? When we hear of men who admit that forceps cases represent 30 to 70 per cent of their practice, we wonder what the antiseptic precautions are which they claim as their justification. Normal labor is a natural process which is best left to itself, and the less the patient is disturbed with the paraphernalia of obstetrics before or after, the better. . . . Until men realize this and recognize the fact that the simplest obstetric operation demands not one whit less of care as to antiseptic precautions than is required of one before opening the abdomen, we shall get no further forward. . . .

"When the practical obstetrician realizes his responsibility, and that no small share of this terrible maternal mortality of a certainty lies at his door, he has made the first step towards true progress. When he

realizes that labor is a natural process which in the great majority of cases it is criminal to disturb; when he realizes that every interference increases the inherent dangers a hundred-fold; and when under this consciousness he brings with him to the lying-in room all that is possible of those principles of antiseptic surgery which have been at the bottom of the triumphs of modern gynecology, we shall not have long to wait for the lightening of the dark cloud which hangs over us now."

More and better maternities, with obstetrics practiced only by clean physicians, with surgical care, and on a scientific basis, is the great obstetrical need of today. Eutocia should be the desire of every woman and the aim of every physician.

The following tables are submitted as further proof of the statements made in the preceding pages.

TABLE 1

PUERPERAL DEATHS, 1855-1909

SCOTLAND

Year	Estimated Number of Confinements	Deaths from Puerperal Fever	Deaths from Other Puerperal Causes	Deaths per 1000 Confinements from Puerperal Fever	Deaths per 1000 Confinements from Other Puerperal Causes
1855	96,850	169	341	1.7	3.6
1856	105,556	143	351	1.4	3.3
1857	107,186	145	304	1.4	2.8
1858	107,858	152	302	1.4	2.8
1859	110,445	175	333	1.6	3.0
1860	109,553	236	328	2.2	2.9
1861	111,010	203	308	1.8	2.8
1862	111,042	130	305	1.2	2.7
1863	113,465	195	376	1.7	3.3
1864	116,526	254	374	2.2	3.2
1865	117,272	213	422	1.8	3.6
1866	117,891	181	356	1.5	3.1
1867	118,285	163	321	1.4	2.7
1868	119,743	140	354	1.2	2.9
1869	117,513	153	410	1.3	3.5
1870	119,687	202	381	1.7	3.2
1871	120,535	225	420	1.9	3.5
1872	123,228	219	391	1.8	3.2
1873	124,173	251	325	2.0	2.6
1874	128,282	378	442	2.9	3.5
1875	128,187	389	459	3.0	3.6
1876	131,283	231	374	1.8	2.8
1877	131,637	163	394	1.2	3.0
1878	131,651	164	380	1.2	2.9
1879	130,450	184	397	1.4	3.1
1880	129,272	185	416	1.4	3.2
1881	130,963	235	462	1.8	3.5
1882	130,965	267	403	2.0	3.1
1883	129,205	363	427	2.8	3.3
1884	134,045	336	371	2.5	2.8
1885	130,881	374	405	2.9	3.1
1886	132,866	270	331	2.0	2.5
1887	129,199	275	338	2.1	2.6
1888	127,958	309	351	2.4	2.8
1889	127,407	277	346	2.2	2.7
1890	126,083	324	363	2.6	2.8
1891	130,815	378	340	2.9	2.6
1892	129,718	315	373	2.4	2.9
1893	131,902	252	336	1.9	2.6
1894	129,036	285	342	2.2	2.7
1895	131,384	253	355	1.9	2.7
1896	134,019	220	357	1.6	2.7

TABLE 1—CONTINUED

Year	Estimated Number of Confinements	Deaths from Puerperal Fever			Deaths from Other Puerperal Causes	Deaths per 1000 Confinements from Puerperal Fever	Deaths per 1000 Confinements from Other Puerperal Causes
		S.	P.	F.*			
1897	133,846		205		331	1.5	2.5
1898	135,852		227		351	1.7	2.6
1899	135,702		214		341	1.6	2.5
1900	136,318		225		342	1.7	2.5
1901	137,150	118	4	158	347	2.0	2.6
1902	137,127	106	3	198	375	2.2	2.8
1903	138,489	110	6	175	418	2.1	3.0
1904	137,512	113	2	126	374	1.8	2.7
1905	136,245	124	5	119	450	1.8	3.5
1906	136,961	123	10	130	442	1.9	3.3
1907	133,492	135	6	87	451	1.7	3.4
1908	136,140	107	3	121	435	1.7	3.3
1909	.....	...	.	...	....	..	..

*S.—Septicæmia and Sapræmia. P.—Pyæmia. F—.Fever.

TABLE 2

ENGLAND AND WALES

Year	Births Registered	Estimated Confinements	Deaths from Puerperal Fever	Deaths from Other Puerperal Diseases	Deaths per 1000 Confinements from Puerperal Fever	Deaths per 1000 Confinements from Other Puerperal Diseases
1855	635,043	658,860	1,079	1,900	1.6	2.9
1860	684,048	709,703	987	2,186	1.4	3.1
1865	748,069	776,125	1,333	2,490	1.7	3.2
1870	792,787	822,520	1,492	2,383	1.8	2.9
1875	850,607	882,509	2,504	2,560	2.8	2.9
1880	881,643	914,708	1,659	1,833	1.8	2.0
1885	894,270	927,809	2,420	2,029	2.6	2.2
1890	869,937	902,563	2,016	2,239	2.2	2.5
1895	922,291	956,881	1,927	2,292	2.0	2.4
1900	927,062	961,831	2,017	2,438	2.1	2.5
1905	929,293	964,146	1,734	2,171	1.8	2.3
1908	940,383	975,652	1,395	1,966	1.4	2.0
			IRELAND			
1865	144,970	150,407	284	644	1.9	4.3
1870	149,846	155,466	360	670	2.3	4.3

TABLE 2—CONTINUED

Year	Births Registered	Estimated Confinements	Deaths from Puerperal Fever	Deaths from Other Puerperal Diseases	Deaths per 1000 Confinements from Puerperal Fever	Deaths per 1000 Confinements from Other Puerperal Diseases
1875	138,320	143,508	442	563	3.1	3.9
1880	128,086	132,890	347	544	2.6	4.1
1885	115,951	120,300	370	495	3.1	4.1
1890	105,254	109,201	252	440	2.3	4.0
1895	106,113	110,093	321	448	2.9	4.1
1900	101,495	105,264	236	414	2.2	3.9
1905	102,832	106,689	227	346	2.1	3.2
1908	102,039	105,866	189	341	1.8	3.2
			FINLAND			
1870	63,748	66,139	...	535	..	8.1
1875	69,521	72,128	...	629	..	8.7
1880	74,784	77,589	...	654	..	8.4
1885	75,129	77,947	...	536	..	6.9
1890	77,860	80,780	...	460	..	5.7
1895	81,783	84,850	...	454	..	5.4
1900	86,339	89,577	...	427	..	4.8
1905	87,841	91,135	...	374	..	4.1
			NORWAY			
1870	50,434	52,325	144	...	2.8	..
1875	56,358	58,472	183	...	3.1	..
1880	58,923	61,133	147	...	2.4	..
1885	61,052	63,342	165	...	2.6	..
1890	60,108	62,362	159	...	2.5	..
1895	62,932	65,292	94	...	1.4	..
1900	66,149	68,630	111	73	1.6	1.1
1905	.....	.....	...	...	..	..
			SWEDEN			
1865	134,281	139,317	299	...	2.1	..
1870	119,838	124,332	380	...	3.1	..
1875	135,958	141,057	457	...	3.2	..
1880	134,262	139,297	338	...	2.4	..
1885	137,308	142,458	314	...	2.2	..
1890	133,597	138,607	173	...	1.2	..
1895	134,599	139,647	187	...	1.3	..
1900	138,139	143,320	121	...	0.8	..
1905	.....	.....	...	...	..	..
			SWITZERLAND			
1880	84,165	87,322	361	382	4.1	4.4
1885	80,349	83,362	436	309	5.2	3.7
1890	78,548	81,494	253	261	3.1	3.2
1895	84,973	88,160	217	281	2.5	3.2
1900	94,316	98,853	193	330	2.0	3.4
1905	94,653	98,203	253	...	2.6	..

TABLE 2—CONTINUED

HOLLAND

Year	Births Registered	Estimated Confinements	Deaths from Puerperal Fever	Deaths from Other Puerperal Diseases	Deaths per 1000 Confinements from Puerperal Fever	Deaths per 1000 Confinements from Other Puerperal Diseases
1875	138,469	143,662	235	651	1.6	4.5
1880	143,855	149,250	166	360	1.1	2.4
1885	148,028	153,580	214	463	1.4	3.0
1890	149,329	154,929	189	351	1.2	2.3
1895	158,130	164,061	154	328	0.9	2.0
1900	162,611	168,710	144	314	0.9	1.9
1905	170,767	177,172	119	295	0.7	1.7

ITALY

1887	1,152,906	1,196,145	2,504	4,436	2.1	3.7
1890	1,083,103	1,123,724	1,682	2,713	1.5	2.4
1895	1,092,102	1,133,061	1,514	1,893	1.3	1.7
1900	1,067,376	1,107,407	1,033	2,001	0.9	1.8
1905	1,084,518	1,125,192	977	2,221	0.9	2.0

From *"The Transactions of the Edinburgh Obstetrical Society,"* 1910-11, XXXVI, 26.

PART III

NITROUS OXID-OXYGEN ANALGESIA IN OBSTETRICS

Technic and Conclusions

Eutocia must be the aim. Nitrous oxid-oxygen analgesia should be a blessing to mothers, but it may, however, be converted into little else than a curse, unless people are educated to the need of better obstetrics and the average methods employed in obstetrical practice are improved.

CHAPTER X

Nitrous Oxid-Oxygen Analgesia in Obstetrics

A comparative study of 104 consecutive cases

The administration of the nitrous oxid-oxygen analgesia in obstetrical practice, or in fact that of any form of analgesia, is not only time consuming and tiresome but it must necessarily increase the cost of the delivery to both the hospital and the patient. It must be determined whether it is worth the time and expense; and whether it has a real value.

There are many physicians who maintain that the suffering of labor is rarely excessive; that there is no surgical shock in obstetrics; and that since the pain is usually

forgotten or at least not mentioned after the successful termination of labor, it is of little importance and may be ignored. But believing that the pain of labor is as real as is other pain; that women in labor show signs of surgical shock; and that it is the physician's duty to relieve the suffering of the parturient, a careful study of 104 consecutive cases admitted to the maternity wards of the Presbyterian Hospital was made in order to learn the facts.

Last April Dr. Grulee, who is in charge of the infants, changed the nursing intervals from three hours to four. It has seemed best to study only the cases which have been delivered since this change was made as the different nursing interval would make it difficult to compare the loss in weight of the babies had the cases delivered prior to this time been considered. Furthermore, the technic of administering the analgesia has been the same for the

cases in this series and they have had the same postpartum care. During the time the patients were in the hospital this paper was not contemplated.

The nitrous oxid-oxygen analgesia was administered to all patients who requested it, provided they could pay for the gases used. We have not been able to furnish it to free patients except in certain cases where it seemed necessary to make the labor as easy as possible. For instance one unfortunate girl had a mitral stenosis and I wanted her to have a labor free from pain and muscular effort, so a Voorhees bag was inserted and just as soon as the pains began, the analgesia was started, and following the expulsion of the bag the baby was delivered with forceps. The results in this case were very happy and the patient made an uneventful recovery.

Group I., made up of 50 cases that had nitrous oxid analgesia, and 9 cases that had

the analgesia with ether substituted for the delivery. There were in this group 44 primiparæ and 15 multiparæ.

Group II., made up of 45 cases that had for the most part no analgesia, some having morphin during labor and some ether during the delivery. There were in this group 18 primiparæ and 27 multiparæ.

TABLE I. FORCEPS AND PITUITRIN

Group I.

Primiparæ: Low forceps were used three times; 1, L. O. P. and 2, R. O. P.; pituitrin before delivery four times.

Multiparæ: Low forceps were used once in a case of mitral stenosis, and pituitrin was administered before delivery once.

Group II.

Primiparæ: Low forceps were used twice because of maternal exhaustion, both in L. O. A. positions. Pituitrin was used once before delivery.

Multiparæ: There were no forceps deliveries; Voorhees bags were used twice; pituitrin was administered before delivery twice.

Version was performed once in each group, both being for transverse presentations.

TABLE II. AVERAGE STAY IN HOSPITAL

Group I.

Primiparæ: 10.8 days after delivery.

Multiparæ: 11.9 days after delivery. Several were in a much weakened condition when admitted to the hospital, which made the longer stay necessary.

Group II.

Primiparæ: 12.2 days after delivery. This does not include one case that developed a puerperal sepsis and remained in the hospital 37 days.

Multiparæ: 11.1 days after delivery.

Table III. Duration of Labor

Group I.

Primiparæ: Averaged 13.5 hours.

Multiparæ: Averaged 7.33 hours.

Group II.

Primiparæ: Averaged 17.9 hours.

Multiparæ. Averaged 10 hours.

Table IV. Weight of Babies at Birth

Group I.

Primiparæ: Babies averaged 7 lbs. 5 oz. (21 males and 23 females).

Multiparæ: Babies averaged 7 lbs. 12 oz. (7 males and 8 females).

Group II.

Primiparæ: Babies averaged 7 lbs. (13 males and 5 females).

Multiparæ: Babies averaged 7 lbs. 2 oz. (12 males and 15 females).

TABLE V. AVERAGE LOSS IN WEIGHT OF BABIES

Group I.

Primiparæ: Babies lost 7.8 oz. or 6.7 per cent of their body weight, the losses ranging from 0 to 16 oz.

Multiparæ: Babies lost 9.4 oz. or 7.58 per cent of their body weight, the losses ranging from 5 to 19 oz.

Group II.

Primiparæ: Babies lost 7.9 oz. or 7.14 per cent of their body weight, the losses ranging from 4 to 13 oz.

Multiparæ: Babies lost 8.4 oz. or 7.37 per cent of their body weight, the losses ranging from 3 to 14 oz.

TABLE VI. LACERATIONS

Group I.

Primiparæ: 36 primiparæ delivered with nitrous oxid-oxygen analgesia had 23 lac-

erations; 20 slight or first degree, 2 second degree, and 1 epesiotomy.

Eight primiparæ with nitrous oxid-oxygen analgesia during the painful stage with ether substituted for delivery had 7 lacerations; 3 slight or first degree, 3 second degree, and 1 epesiotomy. The babies of these eight averaged 8 lbs.

Group II.

Eighteen primiparæ delivered with ether or no anesthetic had 14 lacerations; 7 first degree and 7 second degree.

Table VII. Mortality

Group I.

There was no maternal or fetal mortality.

Group II.

One primipara with a second degree tear developed puerperal sepsis, although she did not have a vaginal examination. She

was in the hospital 37 days but made a good recovery. There were three fetal deaths; 2 premature babies of about seven months, and 1 from injury of the after coming head in a breech delivery.

Table VIII. Postpartum Hemorrhage

Group I.

There were no cases of postpartum hemorrhage.

Group II.

There was one case of postpartum hemorrhage in a case delivered under ether.

This series is small but it includes all the cases entering the maternity department during a period of about four and one-half months, except three Cesarean sections operated in the gynecological clinic, which have no value in this study. The house cases all had the same after care, which

included active and passive exercise, sleeping on the stomach, backrest during the first few days, sitting in a chair on the fourth to seventh day, walking a little after the sixth or seventh day, and home as soon as the patient was strong enough to go with perfect safety. But these statistics also include a few patients of physicians who keep their patients in bed for ten to fourteen days. It is also of interest to note that these patients seemed weaker after the long stay in bed than the other patients did after six or seven days.

From a study of the above tables certain facts seem worthy of more than passing consideration. A study of larger series will undoubtedly alter to some extent the percentages here recorded, but from our experience we believe that the general conclusions will not be materially changed.

1. A group of 44 primiparæ who had the nitrous oxid-oxygen analgesia had

an average labor of 13.5 hours, while 18 primiparæ who had no anesthetic or ether during the delivery had an average labor of 17.9 hours even though the average weight of their babies was five ounces less. The 15 multiparæ who had the analgesia had an average labor of 7.33 hours, and the 27 multiparæ who had ether or nothing had an average labor of 10 hours, yet their babies averaged ten ounces less than those in the first group. Nor was the duration of labor among the unaided cases unusually long. "Speigelberg found in 506 cases the average for primipara to be 17 hours and for multipara 12 hours." (Webster.) Hence it would appear that labor was shortened about 25 per cent by the use of the nitrous oxid-oxygen analgesia.

2. Although the patients had the same postpartum care and were for the most part discharged when strong enough to return home with safety, this study shows

that the 44 primiparæ who had the analgesia had an average stay in the hospital of 10.8 days after delivery, whereas the primiparæ in the other group had an average stay of 12.2 days after delivery. The extra stay of a day and a half will nearly pay for the gas used in the ordinary confinement.

3. The use of the nitrous oxid-oxygen analgesia does not interfere with the supply of milk. The babies of the 44 primiparæ who had the analgesia lost 6.7 per cent of their body weight, while the babies of the 18 primiparæ who were not so fortunate lost 7.14 per cent of their body weight. Since Holt states that the new-born loses an average of 11 per cent of its body weight, the percentage loss in this series is certainly in favor of Dr. Grulee's four hour nursing periods.

4. The use of the nitrous oxid-oxygen

analgesia by assuring better control of the patients, apparently reduces the number and severity of the lacerations.

5. It is not necessary to change from the nitrous oxid to ether or chloroform in the majority of obstetrical cases. However, a hyper-sensitive uterus may necessitate a hypodermic injection of morphin or heroin, or a change to ether or chloroform to lessen the frequency and severity of the uterine contractions, but this can be controlled, at least in the majority of cases, by administering a nitrous oxid-oxygen anesthesia and then returning to a continuous analgesia as is employed by dentists.

6. The use of nitrous oxid does not favor postpartum hemorrhage.

7. The nitrous oxid-oxygen analgesia may be used in all types of obstetrics. In the normal case and properly administered it has a hundred per cent efficency. It may

be used for versions, forceps, and combined with the novocain infiltration for Cesarean sections.

The use of the nitrous oxid-oxygen analgesia will rob labor of its greatest terror.

CHAPTER XI

Technic of Administering Nitrous Oxid-Oxygen Analgesia In Normal Obstetrics

The first consideration in the use of nitrous oxid and oxygen is the choice of a gas machine. While any gas machine may be used, from our experience we would make the following suggestions: (1) The apparatus should be a nitrous oxid-oxygen mixer, as the use of straight nitrous oxid has marked limitations. (2) It should have some type of automatic regulators which will maintain a relatively constant pressure in the gas bags. (3) The mixture of the gases should be controlled by a single valve or lever. (4) Portability is desirable but is secondary to usefulness and durability.

The nitrous oxid-oxygen analgesia as used in obstetrics is similar to that used extensively by dentists, but differs in that it is not administered continuously. The technic which I will describe is used with minor variations by the Obstetrical Staff of the Presbyterian Hospital, Chicago. I believe, with Dr. F. W. Lynch, that a physician will best use this method after carefully testing the effects of nitrous oxid and oxygen on himself.

In administering the analgesia, economy is desirable and may be secured in the following ways: (1) Be certain that there is no leakage of gas from the tops of the cylinders or from any of the connections. (2) Never more than half fill the gas bags and usually keep them about one-third distended. (3) Use the minimum number of regular deep inhalations necessary to secure the analgesia. (4) Do not anesthetise the patient. (5) Use the large cylinders of

nitrous oxid and oxygen in hospital practice.

The automatic regulators on the apparatus we use (the Clark) are set at a point which allows the bags to become about one-third distended when the gases are turned on. In case such regulators are not used the bags should be half filled between uterine contractions. For the women who will cooperate with the physician, the nasal inhaler is the better; but for mouth breathers, hysterical women, and those who will not follow instructions, the face inhaler is necessary.

On admission to the hospital the patient has the usual preparation for delivery. She is told that the nitrous oxid will be given just as soon as her contractions begin to hurt. Generally the patient will not ask for the analgesia until the cervix is fairly well dilated and the uterine contractions coming every few minutes. She is then

placed on the delivery bed and taught how to breathe the gases, and, if the labor is well advanced, how to work. This is at times difficult, but is usually accomplished during the first few contractions. It is advisable to have the room slightly darkened and free from unnecessary noise and conversation. Cold compresses on the forehead covering the eyes are soothing.

With the first suggestion of a uterine contraction, the inhaler is placed in position quickly as the release valve is opened. The patient is given two deep inhalations of pure nitrous oxid; five per cent oxygen is given with the third inhalation and from ten to twenty per cent is given subsequently. The percentages must be determined for each patient. If the labor is well advanced the patient is instructed to hold her breath and bear down after the fourth or fifth inhalation. However, if it is found that two or three inhalations will produce the

analgesia, she should bear down as soon as the analgesia is assured. She is then given another inhalation and again may bear down. The valve is now closed to prevent further escape of the gases, but instead of removing the inhaler the lower edge is raised sufficiently to permit the breathing of air, and is removed only at the end of the contraction. The patient is then told to lie quietly and rest until the next contraction.

It is advisable that the physician follow the progress of labor by means of rectal examinations. A vaginal examination is rarely necessary in a normal case, and should not be made unless there is a fairly definite indication. Unless the physician is alert, the patient, especially if she is a multipara, may precipitate. Although the analgesia has no appreciable effect on the fetus, the fetal heart rate should be followed with the usual care.

During analgesia the patient holds the straps which are fastened to the foot of the bed and makes traction on them during the bearing down efforts of the second stage. When the caput appears at the vulva the patient is warned that *she must immediately obey every instruction,* and she bears down or does not at the request of the obstetrician. More nitrous oxid is often required during the delivery of the head, but the patient should not become anesthetised as she will then lose her self-control and may struggle as with ether.

If the child should be somewhat cyanotic because of prolonged birth pressure or from the cord being tightly around the neck, the mother may be given pure oxygen so long as the cord pulsates, and the oxygen may then be administered to the child.

The nurse or some member of the family may be taught to administer the analgesia for the normal obstetrical case. Nitrous

oxid can only cause death from asphyxia, and in giving the analgesia this is impossible owing to the use of oxygen and the few inhalations required. However, a nitrous oxid anesthesia is difficult to administer and should be undertaken only by the expert.

Self Administration of Nitrous Oxid-Oxygen Analgesia

One of the chief objections to the administration of the nitrous oxid-oxygen analgesia is the necessity of remaining constantly with the patient. For some time one company's engineers have experimented with various suggestions to overcome this objection. They now have a little trigger valve which is attached next to the inhaler and since the gas machine is equipped with automatic regulators the patient may administer with safety her own analgesia during the earlier stages of labor, thus doing away with the necessity of a constant

attendant. There can be no danger to the patient since if she should take enough gas to carry her to the stage of anesthesia her fingers would relax, the valve close and the inhaler fall away.

In using the self administration several points must be borne in mind. The patient must first be taught to understand what is meant by analgesia. She must learn that a few inhalations will deaden the pain and that to use more than the minimum number is to waste gas and increase the cost of administration. She should never make any bearing down efforts except at the direction of the physician. Since the use of the nitrous oxid and oxygen relieves the pain the stage of labor cannot be judged by the loudness of the patient's outcries. Patients may precipitate while under the analgesia without knowing that the baby is being born. With a multipara it is usually wise for the physician to stay near the

patient from the beginning of the bearing down pains. While self administration is practical and may be used successfully, the nurse or the physician should always be near at hand and closely follow the progress of the labor.

Nitrous Oxid and Oxygen in Operative Obstetrics

Dr. J. C. Webster during the past ten years has thoroughly demonstrated that nitrous oxid-oxygen anesthesia is practical for all types of operative obstetrics. I have administered this anesthetic for many obstetrical operations, and, during the past few years, have performed several versions and instrumental deliveries with this anesthesia; but from the experience of the past few months I believe that it is easier to operate with a fairly deep analgesia, as the patient understands what is being done and said, and is less apt to struggle.

In many cases it will be advisable to use a little ether with the nitrous oxid-oxygen, especially if the anesthetist has had but little experience.

The ideal anesthesia for Cesarean section is a combination of the nitrous oxid-oxygen analgesia with the local infiltration of the skin, superficial fascia and parietal peritoneum with novocain (1 to 100). The opening of the uterus does not cause pain, unless traction is made on the broad ligaments, and therefore requires no anesthetic. By injecting an ampule of pituitrin into the uterine wall, as is done by Dr. Webster, and leaving the uterus in the abdominal cavity there is very little blood lost. I first gave the nitrous oxid-oxygen analgesia combined with the novocain infiltration in a case Dr. Webster operated in April, 1915. Since then I have administered it several times and in July performed a Cesarean

section under this anesthesia. The results have been most satisfactory. The patients hear everything that is said but do not suffer mentally as when the operation is performed under the local anesthesia alone.

In administering the continuous analgesia for operative obstetrics the gas bags should be half distended and at times it is necessary to have them two-thirds distended. The mixture of the gases should contain from ten to twenty per cent of oxygen. It is usually advisable to talk to the patient, reassuring her and telling her to breathe naturally. If at any time she complains of pain she should be given a few deep inhalations containing a smaller percentage of oxygen. Try to maintain a deep analgesia in which the patient can hear and understand everything, yet so near anesthesia that she shows lack of coordination in her answers to questions.

Rebreathing in Nitrous Oxid-Oxygen Analgesia

Rebreathing may be practiced to some extent in the nitrous oxid-oxygen analgesia. The use of rebreathing in the normal labor case will reduce the cost of gas about fifty per cent, but if it is continued over a long period, the patient may complain of symptoms similar to those produced by sleeping in a stuffy room. She is apt to have a headache and complain of a bad taste in the mouth. If rebreathing is practiced it is advisable to give the patient pure oxygen for several minutes after the termination of labor.

For obvious reasons rebreathing cannot be employed with the self administration of nitrous oxid and oxygen. However, there is no objection to using it in cases where the continuous analgesia is found necessary.

Use of Narcotics with Nitrous Oxid-Oxygen Analgesia

A long first stage of labor is fatiguing and at times somewhat painful. The uterine contractions are in some cases so frequent and strong that sleep becomes impossible and unless care is used the patient may become exhausted and very nervous before reaching the expulsive contractions of the second stage. In this type of cases we have been accustomed to give a hypodermic injection of morphin sulphate grs. 1/6, or heroin hydrochlorid grs. 1/12, either alone or with chloral hydrate grs. x to xx per rectum.

CHAPTER XII

Reasons for Failures in Securing Analgesia

Failures are comparatively rare in the use of nitrous oxid-oxygen analgesia, but I know of one case where there was apparently very little benefit derived from the use of the gas and it was considered necessary to change to ether to lessen the severity of the pains during the delivery. Since I had never had this experience, I questioned this patient closely to determine the cause of the failure. She stated that the pains came on very quickly; that they were usually intense before she had her first inhalation of the gas; and that she did not feel any effect from the gas until after the contraction was over.

The physician stated that she had an

unusually irritable uterus and that the contractions were very severe. The intern was probably a little slow in administering the gas.

Since the patient did feel some analgesic effect following the contraction the failure was not due to a lack of susceptibility to the nitrous oxid, and it seems probable that had the gas been administered earlier before the painful stage of the contraction that the results would have been different. Recently Dr. Webster had a similar case, but we gave the patient complete relief from pain by administering a continuous analgesia for nearly three hours.

In describing the technic, I called attention to the need of quickness in the administration of the gas. One must work with both hands so rapidly that the patient will get the nitrous oxid with the first inhalation she takes after there is the first suggestion of a contraction coming. Analgesia must

be assured before the height of the contraction, or painful stage, is reached.

However, there are cases in which the extreme irritability of the uterus may become a source of danger to both the mother and the fetus. It is possible that nitrous oxid, which seems to stimulate the uterine contractions, may be contraindicated in this event. In the past it has been the practice of most obstetricians to control these cases with small doses of morphin, and if necessary the morphin may be given during the analgesia. Whether it would be advisable to change to ether or chloroform, can only be determined from the combined experiences of many observers.

In cases with an irritable uterus and very frequent violent contractions, I would advise the administration of a continuous analgesia and if there was still difficulty in controlling the pain the patient may be given anesthesia during the contractions.

At present I do not believe that it is necessary to change to ether or chloroform for any normal delivery. There are many operative cases where the ether may be the better anesthetic, but this depends largely on the operator and the ability of the anesthetist.

CHAPTER XIII

Nitrous Oxid-Air or Nitrous Oxid-Oxygen

A satisfactory analgesia, in most cases, can be obtained with nitrous oxid and air as has been advocated by Guedel. We have used this method with very good results; but it must be remembered that in giving 20 per cent air we are supplying 16 per cent nitrogen for 4 per cent oxygen. Since nitrogen is an inert gas its presence retards, rather than aids, in the securing of analgesia. It would seem more logical to use pure nitrous oxid and give one less inhalation. Four inhalations of pure nitrous oxid will apparently equal in efficiency five inhalations containing 20 per cent air, and since there is no danger from asphyxia in taking five or six inhalations of pure gas I

can see no logical reason for using the air.

In our work we give two deep inhalations of pure nitrous oxid, adding the oxygen in the later inhalations. Our purpose is to secure analgesia as quickly as possible, yet adding the oxygen to prevent the slight headache which may come from the use of pure nitrous oxid.

While we desire to prevent the possible occurrence of a headache, there is a more important reason for using a nitrous oxid-oxygen apparatus and always planning to have a supply of oxygen. We have all seen cases in which the labor was severe and tedious, when because of marked birth pressure or a cord tightly wound about the neck, the resuscitation of the child has been very difficult and at times impossible. Various life-saving devices, such as lung-motors and pulmotors, have been used successfully in some of these cases. Artificial respiration will usually prove sufficient,

especially if the baby is given pure oxygen. In reviewing the records of Mr. A. C. Clark's daughter, I find that she was given pure oxygen so that the blood of the child could be oxygenated through the blood of the mother. It is stated that the cyanosis disappeared in a comparatively short time. I administered pure oxygen to the mother of one blue baby until the cord stopped pulsating with gratifying results. The oxygen tube was later held over the baby's mouth. If we can save one baby in a thousand by having a supply of oxygen, surely it is worth carrying it.

CHAPTER XIV

A COMPARATIVE STUDY OF 154 CONSECUTIVE DELIVERIES AT THE PRESBYTERIAN HOSPITAL, CHICAGO

(*Presented to the Chicago Gynecological Society, Nov. 19, 1915.*)

The use of nitrous oxid and oxygen in the obstetrical work at the Presbyterian Hospital began about eleven years ago. Dr. Webster first used the nitrous oxid-oxygen anesthesia in operative obstetrics when ether and chloroform were contra-indicated. Its use was gradually extended to all types of cases, but prior to 1913 it was restricted to private patients and in no case was it used longer than two hours. During the winter of 1913 Drs. Lynch and Heaney experimented with the nitrous oxid-

oxygen analgesia using it during the entire painful stage of labor in quite a number of cases. The various members of the staff experimented with the method during the winter of 1914, and after we were all convinced that it was safe, practical and not too expensive, Dr. Webster reported it to the Chicago Gynecological Society.

During the past seven months the technic employed has been practically the same, the postpartum care has varied very little, and the infants have been on the four hour nursing intervals. For these reasons it has seemed best to study only the cases delivered during this period. In September, I tabulated 104 cases delivered during the previous four and one-half months. The analgesia was administered to all patients who requested it provided they could pay its cost, and to a few charity cases whose physical condition made an easy labor necessary. There were in this series 44 primi-

paræ and 15 multiparæ who had the nitrous oxid-oxygen analgesia, and 18 primiparæ and 27 multiparæ who had nothing, or ether for delivery. Since making this study 53 more cases have been discharged from the maternity department and 50 of these had nitrous oxid and oxygen during a part or all of the painful stage of labor, the periods ranging from fifteen minutes to seven hours. There were in this second group 23 primiparæ and 27 multiparæ. The table on page 124 shows the comparative findings of the two studies, and is of considerable interest in that the first were more or less selected while the second group of analgesia cases were consecutive.

The statistics recorded in this table speak for themselves and while I must confess that the results were more favorable than any of us had expected, they substantiate all of the claims made for the nitrous oxid-oxygen analgesia, and I believe that within

Deliveries April to November, 1915	Nitrous Oxid-Oxygen Analgesia				No Analgesia	
	Series I		Series II		Series I	
	44 prim.	15 mult.	23 prim.	27 mult.	18 prim.	27 mult.
Av. dur. labor.....	13.5 hrs.	7.33 hrs.	11.25 hrs.	6 hrs.	17.9 hrs.	10 hrs.
Sex of infant.....	21 male 23 female	7 male 8 female	11 male 12 female	13 male 14 female	13 male 5 female	12 male 15 female
Av. wt. at birth...	7 lb. 5 oz.	7 lb. 12 oz.	7 lb. 6 oz.	7 lb. 7 oz.	7 lb.	7 lb. 2 oz.
Av. loss in wt. after birth. First week	7.8 oz.	9.1 oz.	8 oz.	8.63 oz.	7.9 oz.	8.4 oz.
Percentage of wt. lost. First week.	6.7%	7.58%	6.8%	7.25%	7.14%	7.37%
Voorhees bag.....	0	0	1	4	0	0
Pituitrin before delivery	4	1	3	1	1	2
Forceps delivery...	1 L.O.P. 2 R.O.P.	1 mitral stenosis	1 mitral stenosis. 1 no progress 3 hrs.	1 high R.O.P. 2 deep R.O.T.	2 L.O.A. maternal exh'n	0
Lacerations:						
First degree.....	23	3	7	2	7	5
Second degree...	5	4	6	4	7	2
Third degree....	0	0	0	0	0	0
Epesiotomies ...	2	0	3	0	0	0
Maternal deaths...	0	0	0	0	0	0
Still-births	0	0	1 (a)	0	0	0
Died first week....	0	0	1 (b)	0	2 (c)	1 (d)
Post-partum hem..	0	0	0	0	0	1
Failure to secrete milk	0	0	0	0	0	0
Days in hospital after delivery....	10.8	11.9	11.7	10.7	12.2	11.1

(a) Patient admitted to maternity 30 minutes before delivery, had not felt life since labor began. Only had N2O-O less than 20 minutes.

(b) Died 12 hrs. after birth. Necropsy showed patent foramen ovale.

(c) One premature 6½ mo. One injury in delivery of the after-coming head in a breech presentation. Necropsy showed rupture of the longitudinal sinus.

(d) Case of hydramnios with premature delivery at 6 months.

From the clinic of Dr. J. Clarence Webster, Presbyterian Hospital, Chicago.

the year these results will be confirmed by obstetricians in all parts of the country.

In administering the nitrous oxid-oxygen analgesia there are several points which deserve special attention. It must be remembered that nitrous oxid anesthesia cannot be given according to ether standards or rules, and furthermore, that nitrous oxid-oxygen analgesia differs from both. In administering the obstetrical analgesia the patient will never become cyanotic since this can only follow anesthesia and is the first symptom of asphyxiation. With our present technic there is little chance of anesthetising the patient since we determine the minimum number of regular deep inhalations required to produce analgesia and when these are given the valve is closed and the edge of the inhaler is raised sufficiently to permit the breathing of air. As the contractions increase in duration and severity one or more inhalations is added, but it

is rarely necessary to continue the gas to the end of the contraction. In case the uterus is very irritable and the contractions come on so quickly that the patient feels severe pain before the analgesia can be secured it may be necessary to administer a continuous analgesia, but again there is no danger of anesthesia or cyanosis if fifteen or twenty per cent of oxygen is added. In a case that Dr. Webster confined recently, using the usual technic we were unable to relieve the suffering, but this was overcome by administering a continuous analgesia for nearly three hours. Thus far I have not had a case in which it was not possible to relieve the suffering of labor by means of the nitrous oxid-oxygen analgesia, and I have used it in all types of cases and all classes of patients. Patients who refused to take anything have been forced to take the gas as a means of securing quiet in the maternity, patients who understood no

English or German have been taught to take the analgesia with very little difficulty, and within a few contractions.

The administration of the nitrous oxid-oxygen analgesia, or in fact that of any form of analgesia has required a constant attendance on the patient which is very tiresome and at times quite difficult. The self-administration of chloroform *a la rèine* has long been practiced in certain parts of Europe, and it has seemed that a similar method might be practical with the nitrous oxid. After several conferences with the engineers of a well known company, they have perfected a release valve which is attached near the inhaler by means of which it is practical for the patient to administer her own analgesia during the greater part if not all of the painful part of labor. This valve serves a double purpose in that it prevents the mixture of air with the gas in the tube during the intervals

between pains. In using the self administration I would suggest that the mixture contain about five per cent oxygen, and that the mixing valve need not be changed except in case a different percentage of oxygen is desired. Should the patient not follow instructions and take more than the required number of inhalations she can do no real harm since if she should become anesthetised her fingers would relax, the inhaler fall away and the spring exhaust valve automatically close.

Nitrous oxid-oxygen analgesia in obstetrics has passed the experimental stage and is now practical in all classes of cases. In the practice of every physician who understands the science of obstetrics it is an absolutely safe and comparatively simple method of eliminating the suffering and shock of labor. When it is used the delivery room is as quiet as any other operating room. However, with the analgesia the

stage of labor cannot be judged by the nature of the outcry and the obstetrician must carefully watch his patient or she will deliver her baby and not know that it is being born.

CHAPTER XV

Conclusions

Experience with all types of cases, all classes of patients, and the various forms of obstetrical analgesia has led to the following general conclusions:

1. The pain of labor is as real as is any other pain and should be relieved. Childbirth may be made relatively free from suffering.

2. Obstetrical analgesia is a conservative measure.

3. While most of the drugs used in securing obstetrical analgesia have serious limitations and several contraindications, the nitrous oxid-oxygen analgesia may be used in practically all classes of cases. It has no contraindications other than a threatened

rupture of the uterus and then morphin is the analgesic of choice.

4. Morphin, heroin, chloral hydrate or scopolamin, may be used to rest the patient in the event of a prolonged first stage of labor.

5. When there is a premature rupture of the membranes, with the cervix not effaced, some type of rubber bag is often inserted to aid in the dilatation of the cervix. The analgesia may be started just as soon as the patient complains of pain. A small dose of pituitrin after the expulsion of the bag will prevent secondary inertia.

6. Any form of obstetrical analgesia, *properly administered,* is safer and better for the patient than no analgesia.

7. *The nitrous oxid-oxygen analgesia is absolutely safe in the hands of any physician who understands the practice of obstetrics, and properly administered will relieve the suffering in every case in which it is*

used. The pain may not be entirely destroyed in every case but is materially reduced and made bearable.

8. Women who have the analgesia during the painful stage of labor have shorter labors and do better afterwards than do those who have no analgesia or ether just for the delivery.

9. From a study of 154 consecutive cases entering the maternity wards of the Presbyterian Hospital, Chicago, it would seem that the use of the nitrous oxid-oxygen analgesia reduces the duration of labor 25 per cent.

10. The use of the nitrous oxid-oxygen analgesia does not interfere with the supply of milk, but, by lessening the shock, favors the secretion of milk.

11. The use of the nitrous oxid-oxygen analgesia in the cases studied decreased the number and severity of the lacerations.

12. The nitrous oxid-oxygen may be

used for all types of operative obstetrics, and it is rarely necessary to resort to ether or chloroform.

13. While the cost of labor is slightly increased from the use of the nitrous oxid-oxygen analgesia, the cost is insignificant when compared to the relief of suffering. The cost of the gases used in the ordinary obstetrical case varies from fifty cents to one dollar per hour.

14. The nitrous oxid-oxygen analgesia may be administered in the home as well as the hospital and by every physican who practices obstetrics.

15. The use of the nitrous oxid-oxygen analgesia will rob labor of its greatest terror. It is both sane and safe, and is a logical method of relieving the suffering during childbirth.

16. Eutocia must be the aim. Nitrous oxid-oxygen analgesia should be a blessing to mothers, but it may, however, be converted

into little else than a curse, unless people are educated to the need of better obstetrics and the average methods employed in obstetrical practice are improved.

PART IV

NITROUS OXID-OXYGEN ANALGESIA AND ANESTHESIA IN OPERATIVE PROCEDURES

The surgeon who would operate with nitrous oxid-oxygen analgesia or anesthesia should be familiar with its administration.

CHAPTER XVI

Nitrous Oxid-Oxygen Analgesia and Anesthesia in Operative Procedures

Nitrous oxid with oxygen is used by more physicians today than ever before. Because of this increased usage many questions have arisen regarding the safety of this anesthetic in the hands of the physician who has had little experience with its use. Excellent chapters on the use of nitrous oxid are to be found in Gwathmey's book on Anesthesia and in "The American Year Book of Anesthesia and Analgesia for 1915," but, since there are minor variations in technic, that used by the Gynecological Staff of the Presbyterian Hospital, Chicago, is here recorded.

Nitrous oxid-air and nitrous oxid-oxygen anesthesia have been used extensively by

Dr. J. Clarence Webster and his associates for more than ten years. During the entire period there has not been a single death under this anesthesia. It should be noted that two patients did stop breathing and artificial respiration was required, but this was due to the lack of oxygen in one case, and in the other interference with respiration from a combination of mucus and large tonsils. It should also be stated, that during this period, nitrous oxid and oxygen has usually been the anesthetic of choice for the desperate cases, with little chance of recovery, in which the anesthetic was a matter of grave concern. We are all of the opinion that this anesthetic has been the means of saving many patients who would probably have succumbed to the added toxicity either of ether or chloroform.

The writer's personal experience with nitrous oxid-oxygen anesthesia began in 1909, when, as an intern, he gave anesthetics

for Dr. Webster in his surgical work. It has continued with a constantly increasing appreciation of the great value of this anesthetic in major as well as minor surgical procedures. The chief difficulties in the use of this anesthetic are the securing of relaxation and an even anesthesia. The work of Crile and others has demonstrated that relaxation may be secured with nitrous oxid and oxygen by using a local infiltration or a nerve blocking with a solution of novocain, either with or without ether sequence. More recently some of us have substituted the nitrous oxid-oxygen analgesia for the anesthesia and have found it well suited to major abdominal operations. I have also performed vaginal operations such as dilatation and curettage, amputation of the cervix, anterior colporrhaphy and posterior colpo-perineorrhaphy, using the analgesia without nerve blocking. From the experience of the past six months, I am satisfied

that nitrous oxid-oxygen analgesia in both major and minor surgery, especially when combined with the local infiltration of novocain, will prove, in the hands of many surgeons, a satisfactory anesthetic for an ever increasing number of cases. A small amount of ether may be necessary in some instances, especially if the patient is very nervous or irritable.

Our patients are given from 1/100 to 1/60 gr. atropin hypodermatically, preparatory to operation. We never use morphin or morphin and scopolamin in place of, or in addition to, the atropin. In no instance have we felt the need of using quinine and urea hydrochlorid as is advocated by Crile. Our patients, for the most part, do not show the usual manifestations of surgical shock. They suffer less following the operation and make a smoother recovery than do those who have a deep ether anesthesia. These results have been duplicated by several

other operators here and elsewhere, and the writer does not offer them as original with the Gynecological Staff of the Presbyterian Hospital.

CHAPTER XVII

Contraindications to Nitrous Oxid-Oxygen Anesthesia

Nitrous oxid and oxygen, combined in suitable proportions and properly administered, is unquestionably the safest of general anesthetics for cases in which there are no cardiac or respiratory difficulties. But since this anesthetic is not entirely suitable to all cases, the exceptions to its use are of considerable importance to the physician who has only a limited experience with nitrous oxid and oxygen. Writing on this subject, Sajous gives the contraindications as follows: "Circulatory abnormalities constitute the most frequent contraindication to nitrous oxid, which is to be avoided both in well-marked atheroma, especially if high blood pressure coexists, and in cardiac dila-

tation, with or without a valvular lesion. Mitral stenosis, aortic regurgitation, and the 'beer heart' are generally held to contraindicate nitrous oxid, as does also the combination of high blood-pressure with a weak cardiac first sound. Buxton regards the anemic individual, the 'overgrown' boy; the nervous, sensitive child subject to fainting; the child with congenital cyanosis, and the person with an hypertrophied heart as among the most dangerous types of individuals for nitrous oxid, syncope and asphyxia easily occurring in these cases. *With care to obviate struggling and undue exclusion of air or oxygen, no absolute contraindication to gas anesthesia is presented even in these cases.*

"Marked respiratory embarrassment, especially if due to a swelling which will be made worse through venous congestion, contraindicates nitrous oxid anesthesia, but if the dyspnea be of minor extent, as is fre-

quently the case in patients with tonsilar swellings, Ludwig's angina, glandular or other enlargements exerting pressure on the respiratory channels, enlarged thymus, large adenoid growths, intra-abdominal effusions or growths pressing on the diaphragm and heart, obesity, pleural adhesions, and general affections causing dyspnea, nitrous oxid may be used provided great care be taken to avoid asphyxia during the anesthesia.

"In the aged, intolerance of asphyxia and circulatory stress is likewise a feature to be remembered, especially if chronic bronchitis is present; nitrous oxid anesthesia is not, however, contraindicated by old age *per se.* In pregnant women it should be borne in mind that excessive exclusion of air may injure the fetus or bring on labor, while in children marked jactitations result from similar carelessness in the use of the anesthetic.

"Nitrous oxid cannot be relied upon to

bring about general muscular relaxation, unless administered in combination with oxygen by an experienced anesthetist." (*Sajous's Analytical Cyclopedia of Practical Medicine, Seventh Ed., 1915,* VII, *60.*)

CHAPTER XVIII

Administration of Nitrous Oxid-Oxygen Anesthesia

Preparation of the Patient. The patient should be prepared much as for any other anesthetic. The stomach should be empty or vomiting may occur and interfere with the anesthesia. There should be no constricting bands about the neck, chest or abdomen. The bladder and rectum should be empty. This preparation, while not absolutely necessary for some cases, minimizes the dangers and favors a smooth anesthetic. Atropin grs. 1/100 to grs. 1/60 favors a clear respiration.

Posture of Patient. It is desirable that the patient be in such a position that there may be the greatest muscular relaxation,

therefore a reclining or semi-reclining posture should be secured.

Apparatus. There are several good nitrous oxid-oxygen machines manufactured at the present time and any one may be used with satisfactory results. The anesthetist must, however, be familiar with the mechanism of his apparatus, and the machine which requires little manipulating enables him to give more attention to the patient. A free, easy passage of the gases is necessary. All valves must be working perfectly and easily. The apparatus should have two bags, one for nitrous oxid and one for oxygen, or some other form of sight feed which will show that both gases are passing at all times. Machines with automatic pressure regulators should also have connections which will allow a direct passage from the cylinders to the gas bags in case the regulating device should fail, as is possible with any delicately adjusted

mechanism. Care must be taken to prevent a leakage of gas from imperfect valves at the tops of the cylinders and the connections about the apparatus. A little leak is one of the greatest sources of unnecessary cost, and it may in course of a few operations prove very expensive.

In hospital practice, the large cylinders of nitrous oxid and oxygen will reduce the expense of the anesthetic. But for the office, the smaller cylinders, while more expensive, will probably be more satisfactory. Since nitrous oxid may be compressed into a liquid form while oxygen remains a gas, a cylinder of nitrous oxid contains two and one-half times as many gallons as does one of oxygen. The amount of nitrous oxid used in a given case may be determined by weighing the cylinders before and after the operation. One ounce in weight is equivalent to four gallons of nitrous oxid.

Administration. Having tested the ap-

paratus to make certain that everything is in perfect working order, the gas bags are about half distended, the inhaler is placed carefully over the patient's face and the release valve opened. The patient is instructed to take slow deep inhalations. The mixture should contain not more than five per cent of oxygen. After a few inhalations, the pressure in the bags is gradually increased until they are moderately distended. Excessive pressure should be avoided, since it will not only make the patient exhale against pressure, but it will waste gas and thereby increase the cost of the anesthetic.

The mixture of nitrous oxid and oxygen is odorless, but has the slightly sweetish taste of the nitrous oxid. When given under low pressure it causes no unpleasant sensations. As the patient comes under the effects of this anesthetic there is experienced a sensation of fullness in the head, warmth

in the lips, and a peculiar though not unpleasant sense of numbness creeping over the body. The patient is now in the stage of analgesia or the first degree of nitrous oxid anesthesia. This stage may be maintained indefinitely by adding to the mixture a sufficient proportion of oxygen, usually about twenty per cent.

With the bags well distended and a low percentage of oxygen the patient quickly passes beyond the stage of analgesia and loses normal consciousness. During this stage of second degree anesthesia the power of coordination is destroyed. Disturbed psychical states may arise and the patient usually dreams. Great care must be exercised during this stage, since any unusual noise, handling or attempt at an operative procedure may result in an excitement stage with kicking, twisting and throwing of the arms. Should the patient become excited, the gas may be removed until he is again

quiet or he may be held until a deeper anesthesia is secured. I usually prefer the former procedure and in cases with circulatory or respiratory difficulties consider it essential to safety. It seems probable that some of the bad results from administering this anesthetic to children and weakened individuals has been due to the forcing of the anesthetic during a period of excitement.

The time required to secure the deep anesthesia or the third stage, varies considerably with different individuals. It seems best that it be induced slowly, since patients who are quickly anesthetized with gas under considerable pressure are apt to cause more trouble in the attempt to secure a smooth anesthesia. The first evidence of the deep anesthesia is the change in the respiration from the regular but somewhat quickened respiration of the second stage to the more shallow and somewhat arhythmic breathing of the third stage. The peculiar

throat sounds of deep anesthesia may now become audible. The pulse is moderately elevated. There is relaxation of the voluntary muscles which had remained rather rigid during the second stage. The patient is now ready for operation.

Should the oxygen supply be kept too low the patient will soon become very dusky and show the rigidity of a beginning asphyxia. This is the great danger sign in the administration of nitrous oxid anesthesia. The reason it is difficult to administer a smooth nitrous oxid anesthesia arises from the ease and rapidity with which a patient passes from the second to the fourth stage of anesthesia. In the former, operative procedures are impossible, and in the latter, artificial respiration may become necessary.

If the nitrous oxid-oxygen anesthesia is well administered *the patient should never become cyanotic.* More careful watching is

necessary with this anesthetic than any other. Only experience will teach the anesthetist how to maintain a proper pressure in the bags and a proper mixture of the gases. Each case must be handled individually. Usually more oxygen should be added after the deep anesthesia is secured. *Any rigidity in the presence of cyanosis means asphyxiation and calls for air or oxygen, not more nitrous oxid.*

Ether Sequence

Ether sequence may be instituted by passing a part or all of the mixture of nitrous oxid and oxygen through a chamber containing ether. A little ether added in this way will aid materially in maintaining relaxation. While it will increase the tendency to post-operative nausea and vomiting, it seems to be almost indispensable in some cases, and for a large group of cases has distinct advantages over the deep anes-

thesia with ether or chloroform. A comparatively small amount of ether is used and the time required for its elimination is greatly reduced.

If ether sequence is used, the pressure in the gas bags should be reduced until they are not more than half distended. And since the patient may be made to rebreathe at least half of the time, a comparatively small quantity of nitrous oxid and oxygen is used. During the administration of this combination the percentage of oxygen should be materially increased, the percentage varying from 10 to 50 per cent. according to the case.

Rebreathing

The experiments of Henderson on acapnia and the value of carbon dioxide as a respiratory stimulant, were given a practical application by the work of W. D. Gatch in rebreathing. While many do not

agree with his rules, most operators admit that rebreathing not only reduces the cost of the anesthetic, but has a distinct value in maintaining a smooth anesthesia.

In surgical work we have found that many patients may be made to rebreathe the gases at least fifty per cent. of the time. With the automatic regulators set so that the gas bags remain only about one-third distended, the valve connecting the rebreathing bag is left wide open. The patient is now given four to six inhalations of the mixture with the exhaust valve on the inhaler half open or on the first shoulder. There is with this some back pressure into the rebreathing bag during each exhalation, but since it is through a large tube and into the resilient and not distended rebreathing bag it requires no extra effort on the part of the patient. The exhaust valve is now closed and the patient is permitted to rebreathe from four to eight times. But

since the gases are not shut off during this to-and-fro breathing a fresh supply of nitrous oxid and oxygen is constantly being added. If the ether sequence is being employed the to-and-fro breathing will be through the ether chamber. As has been stated, the percentage of oxygen must be increased when rebreathing is practiced to this extent.

CHAPTER XIX

Nitrous Oxid-Oxygen Analgesia in Surgery

After finding that the nitrous oxid-oxygen analgesia was more satisfactory than the anesthesia for most of the common obstetrical operations I began to experiment with it in surgical work. It has proved satisfactory for some rather extensive vaginal operations and, combined with the local infiltration with novocain 1 to 100, it has been used in various abdominal operations.

Evans reports (*Anesthesia Supplement, Am. Jour. Surg., 1916,* xxx, *p. 56*) that he has given nitrous oxid-oxygen analgesia throughout for the following operations:

Curettage.

Amputation of the cervix.

Plastic for cystocele.
Repair of the perineum.
Curettement of necrotic bone.

Varicocele.	Empyema.
Hydrocele.	Hernia.
Circumcision.	Tonsillectomy.

Sub-mucus resection.
Excision tubercular nodes of the neck.
Leg amputation.
Radical breast amputation.
Exploratory laparotomy.
Appendectomy.

While I have not had such a wide experience with the nitrous oxid-oxygen analgesia in surgical procedures as that reported by Evans, yet my own results indicate that it has a place in both major and minor surgery. Certainly there are no contra-indications to the use of the analgesia except the inability to control the patient, and its safety should appeal to every surgeon.

CHAPTER XX

Nitrous Oxid-Oxygen Analgesia with Local Anesthesia

The value of local anesthesia in major as well as minor surgery is well known and it is extensively employed both in America and in Europe. More recently, Crile has made popular the combining of nerve blocking and nitrous oxid-oxygen anesthesia. In April, 1915, I gave nitrous oxid-oxygen analgesia combined with a local infiltration of novocain to a patient on whom Dr. Webster performed a Cesarean section. Since then I have performed two Cesarean sections, using this anesthetic, and have seen it used by other members of our staff in several more cases. This combination seems to be the most satisfactory anesthetic for Cesarean sections.

Because of the very satisfactory results in the above mentioned cases, the several members of the Gynecological Staff of the Presbyterian Hospital have tested its value in different types of abdominal operations. It is now our anesthetic of choice for appendectomies and other operations not requiring excessive handling of the viscera. *When using this anesthetic, however, the patient must be kept constantly in mind since he hears and remembers everything that is said in the operating room.*

When one has mastered the technic necessary to the successful use of local anesthesia, very extensive surgical procedures are easily carried out under the combined local anesthesia and nitrous oxid-oxygen analgesia. In abdominal operations there is little difficulty in securing a complete relaxation if the parietal peritoneum is well anesthetized with the novocain. Should, however, the patient become nervous and

unruly, the analgesia may be deepened to anesthesia, with or without ether sequence.

Use of Hypodermatic Medication

Morphin is not given preparatory to operation. B. F. Davis, who has made a careful study of this subject, says: "Morphin alone, preceding local anesthesia, adds nothing to the efficiency of the anesthetic, and causes post-operative nausea and vomiting in 25 per cent. of the patients; it makes the patient 'dopey' and hence deprives the operator of the cooperation of the patient, which at times may be valuable." (*Jour. A. M. A., 1916,* LXVI, *255.*)

Heroin hydrochlorid grs. 1/12 or morphin grs. 1/6 to 1/16 is given to the patient after operation at intervals of not less than six hours when the suffering cannot be controlled otherwise. We usually prefer the heroin, since it seems to have less effect on the intestines.

Atropin grs. 1/100 to 1/60 is given preparatory to the operation. It tends to paralyze the nerves to the secretory glands and the heart, although it acts as a stimulant to the central nervous system. Because it lessens the amount of secretions, the patients who have atropin breathe easier and usually take a better anesthetic. While it may interfere to some degree with the eye reflex, this is of little importance. We have the patient's eyes covered with cotton and gauze before the anesthetic is started. Very little can be gained by testing the eye reflex and there is always the danger of injuring the cornea. *The logical guides for the anesthetist are respiration, color, relaxation and pulse.* The lobe of the ear gives the best index to the color. In administering nitrous oxid and oxygen the patient may become slightly dusky at times, but should never become cyanotic.

Conclusions

Nitrous oxid-oxygen is an anesthetic of the greatest value in both obstetrics and surgery. While its administration is comparatively simple, considerable experience is necessary before one can obtain the best results. *It does not act like ether or chloroform and cannot be administered according to the same rules.* The surgeon who would operate with nitrous oxid-oxygen analgesia or anesthesia should be familiar with its administration.

Properly administered nitrous oxid and oxygen is the safest of anesthetics. Deaths have occurred during operations performed under nitrous oxid anesthesia. Most of them have resulted from asphyxiation, which should not have occurred had cyanosis been remembered as the chief danger sign. A few deaths may have resulted from impurities in the nitrous oxid, but these are

removed by the modern methods of manufacturing and storing the gas.

Nitrous oxid with air in various proportions may be used to some extent, but nitrous oxid with oxygen, because of its greater safety and efficiency, should be chosen for all extensive work under analgesia or anesthesia.

What the Critics Have Said

This book is wholesome, scientific and helpful.—*The Public Health Journal, Toronto.*

It is a book that should be read by every intelligent adult.—*Joseph Brown Cooke, M. D.*

This is a valuable book for every man doing the least obstetrical work.—*Western Medical Times.*

This book is important and we take pleasure in recommending it.—*Massachusetts Medical Journal.*

It most opportunely follows the violent hysteria of last year in regard to painless childbirth.—*Archives of Pediatrics, New York.*

The object of this great book is most laudable. Get the book—it is worth its weight in gold to the very next primipara you attend.—*The Southern Clinic.*

A timely book and stirring proof is presented that Dr. Davis offers the safest and best method to secure painless childbirth.—*The Medical Summary, Philadelphia.*

May be commended for its rational attitude and the acknowledgment that no matter what type of anesthesia is employed thorough and clean obstetrics is essential.—*American Journal of Obstetrics, New York.*

What the Critics Have Said

A book of great interest to women.—*Pasadena Star.*

A method which should receive the consideration of every physician whether he practices obstetrics or not.—*Pacific Medical Journal.*

A book of real scientific value and it is a competent discussion of timely interest to the layman as well as the physician.—*The Continent.*

It places before the medical profession many vital facts in obstetrics which should drive home with sledge-hammer blows.—*The Hospital World, Toronto.*

Dr. Davis has here added to obstetric literature a valuable contribution to the subject of analgesia, or obstetric anesthesia.—*The Canadian Medical Association Journal, Toronto.*

Why not take advantage of an opportunity of getting a real, scientific discussion of the question of painless childbirth such as given in this book. It is worthy of a careful perusal by every physician.—*Texas Medical News.*

This book is particularly welcome at this time, with its definite assurance to the profession and the public that painless childbirth is possible and safe. The method as practiced by Davis is so rational and safe as to receive the general endorsement of the medical profession.—*American Journal of Surgery.*