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Obstetrical analgesia and anesthesia

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For most women childbirth is a painful experience. Throughout the ages babies were born without the help of drugs. The introduction of anesthesia has not only relieved immense suffering, but has also reduced maternal and fetal mortality and morbidity, particularly by making instrumental and surgical deliveries possible. The request of Queen Victoria in 1853 to deliver her eighth child with the help of chloroform, against the opposition of the medical profession as well as the Church, was not only an act of personal courage but also of historical significance. It made obstetrical anesthesia acceptable. The Church has since divorced itself from arguments as to whether anesthesia is desirable in childbirth; Pope Pius XII stated in 1957 that man has the right to conquer the forces of nature and therefore to use all available means to avoid or suppress physical pain. No mother is obliged on religious grounds to refuse pain relief by natural or artificial means.

With the change to an in-hospital practice of obstetrics (over 94% in the U.S.), routine methods of pain relief were frequently employed. Heavy sedation with barbiturates, opiates, and amnesics often created undesirable situations in individual patients and general anesthesia was administered by incompetent personnel. Partly in opposition to such institutional routines, "natural" childbirth and other psychoanalgesic techniques were advocated, using the bad effects of anesthesia on mother and child as an argument in their favor.

In the last decades, control of infection and improved prenatal care have dramatically reduced fetal and maternal mortality. This improvement has focused attention on adverse factors introduced by the obstetrical management. Modern concepts in obstetrics advocate the frequent use of episiotomy, outlet forceps,

forceps rotation, and cesarean section; all procedures that require effective anesthesia. The active participation of the anesthetist in the conduct of pain relief in obstetrics provides a safer and more understanding use of available techniques.

Knowledge of the physiology of labor and the conduction of pain are basic to the safe use of analgesic drugs and anesthetic agents in obstetrics.

Uterine contractions start bilaterally as synchronous waves in an area near the insertion of the fallopian tubes and consist of longitudinal shortening and circular constriction of the uterus. Discoordination of these waves of contraction makes labor painful and ineffective. A graphostatistical cervi-metric method was evolved by Friedman to gauge the progress of labor (Fig. 1); he divides the first stage of labor into a latent phase, followed by an active phase characterized by forceful contractions and a steady progressing dilatation of the cervix. Uterine contractions can start and progress in the absence of a nerve supply to the uterus; the exact role of the autonomic nervous system in the course of normal labor is incompletely understood. During the latent phase, labor may be arrested by strong sympathetic stimuli and regional anesthetic

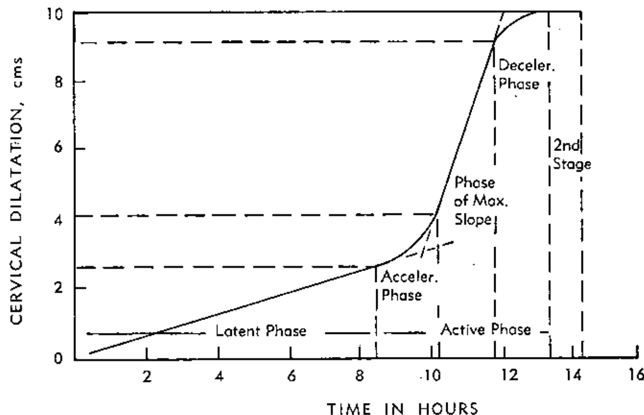


Fig. 1. Labor curve in primigravidas at term (Friedman, E. A., Obst. & Gynec. 6:567, 1955)

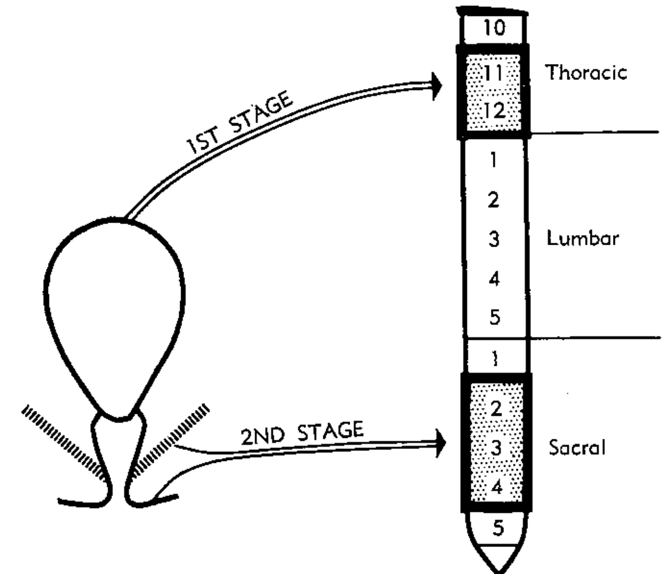


Fig. 2. Pain pathways in labor (schematic) (From Bromage, P.R. C.M.A.J. 85: 1136, 1961)

techniques, which block the autonomic supply to the uterus. Analgesic drugs have been held responsible for a slowing or the arrest of uterine contractions.

During the first stage labor pain originates mainly in the musculature of the lower uterine segment and cervix and travels within the sympathetic plexus to the eleventh and twelfth thoracic segment (Fig. 2). Interruption of these fibers (presacral neurectomy, paravertebral sympathetic nerve blocks) abolishes the pain of uterine contractions. With the passage of the fetal head through the birth canal, painful stimuli arising within the structures involved are conducted through sensory elements of the lumbosacral plexus. A block of the sensory nerve supply to the birth canal and particularly of the nerve supply to the perineum and pelvic floor (pudendal nerve) relieves the pain during the second stage of labor. Elements of the sacral plexus

initiate the bearing down reflex that recruits voluntary muscular efforts to aid in the expulsion of the infant.

The tolerance and the intensity of pain varies greatly from patient to patient; physical and psychological factors play an important role. Fear and anxiety will sharpen pain perception, while mental distraction makes pain more tolerable. The actual intensity of pain depends, probably, on the force and coordination of contractions, and on the resisting forces, which are

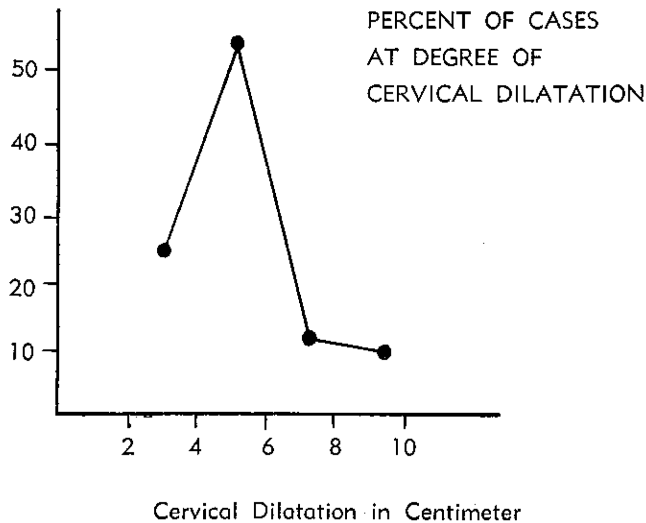


Fig. 3. Percent of primiparas patients requiring analgesic drugs at the indicated degree of cervical dilatation. (Flowers et al. Obs. & Gyn. 16:212, 1960).

determined by the size of the birth canal, the size and presentation of the fetal head, and the tissue resistance. Frequency of contractions and the duration of labor influence tolerance. Severe pain can be tolerated for a short period, while even moderate pain becomes unbearable with the passage of time. Pain is the major contributing factor to maternal exhaustion and after prolonged labor the physical condition of the mother is much better with effective pain control.

An assessment of the first need for analgesic

drugs in primiparas was made by Flowers (Fig. 3); in over 50% of his patients this need occurred with a cervical dilatation of 4-5 cm., i.e., in the early active phase of labor; about 20% required sedation earlier, the remainder after labor had progressed further.

Drugs or methods to provide pain relief during labor must also be assessed according to their effect on the fetus. Practically all drugs given to the mother will cross the placenta and enter the fetal circulation. Opiates, barbiturates, and anesthetic agents depress the respiratory center of the fetus and, if used excessively, increase the need for resuscitation of the newborn. Regional anesthesia involves risk of systemic reactions or hypotension in the mother, thereby reducing the fetal oxygen supply. However, the administration of analgesic drugs and anesthetics is only one of several causes of fetal depression, and omission of such agents does not preclude the occurrence of fetal depression.

The presently advocated methods of pain relief during labor and delivery may be classified under the headings psycho-analgesia and pharmaco-analgesia.

I. Psycho-analgesia

Reid's "natural childbirth" and hypnosis have probably received the greatest publicity. Hypnosis is undoubtedly an effective method but is successful only in a small proportion of patients after time consuming preparation. In reviewing the other psycho-analgesic techniques, one cannot help but feel that their benefits are mostly psychological. Preparations and training probably do little to eliminate pain but help the patient to endure it better. Belief in the method appears to be the key to success. Favorable reports usually present highly selected groups of patients. It should be noted that up to 20% of a nonselected obstetrical population cannot be delivered without general or regional anesthesia, because of the necessity for active intervention by the obstetrician. It may be estimated that of the remaining normal deliveries at least 50% are able to withstand the pain of labor and delivery

without undue suffering, particularly with encouragement. There is, at present, no conclusive evidence that psycho-analgesic techniques shorten labor, reduce hemorrhage or fetal complications, or strengthen the mother-child relationship. On the other hand there are reports that, in strongly motivated patients, failure to achieve "natural childbirth" has led to difficulties when anesthesia became necessary and possibly caused postpartum depression. Hypnosis or hypno-analgesia may also have undesirable psychiatric sequelae. The great contribution made by these techniques is a better education of the mother and consideration of her emotional needs. There is little doubt that allaying fear and anxiety will reduce the need for sedatives and pain relieving drugs. Obstetrical anesthesia and analgesia therefore begins in the obstetrician's office. Each patient should receive individual consideration and an optium of psychological preparation, as well as an explanation of the methods of pain relief available.

The obstetrician must have a good knowledge of the methods of pain relief. For these he will have to rely in part on an anesthetist and it is in his interest to foster a mutual understanding of the problems, possibilities, and limitations within the local area of his practice. On this basis, the obstetrician may in advance select a certain way to manage his patient, giving due consideration to the obstetrical management, possible complications, the patient's physical and emotional status, and the anesthetic skill and experience at his disposal. The same considerations should guide residents and nurses working in the delivery suite.

II. Pharmaco-analgesia

The use of analgesic drugs, systemically or regionally, should be employed when needed. There is a tendency to give analgesic drugs only after a certain degree of cervical dilatation has been reached, for fear that too early administration may retard or even arrest labor. However, the need for analgesic drugs before 4 cm. cervical dilatation only arises with severe

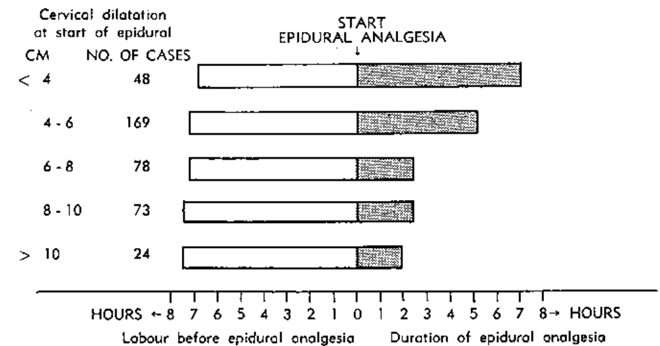


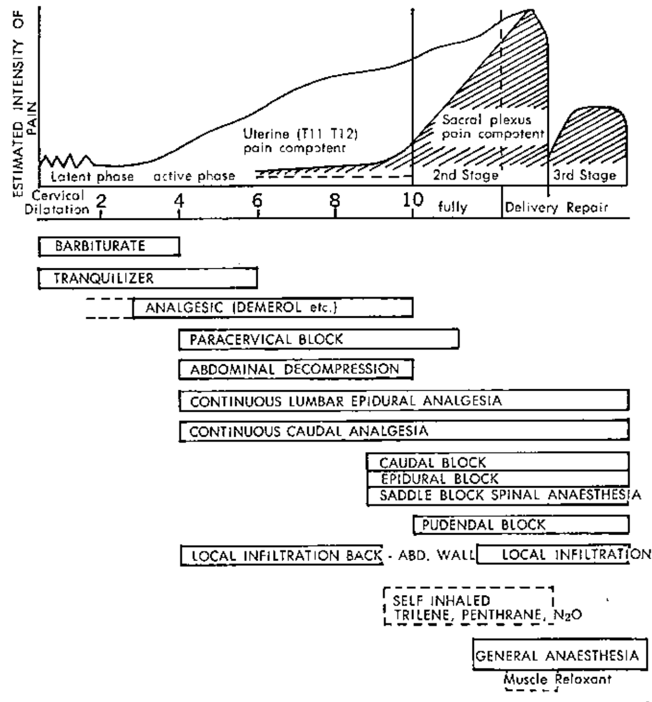
Fig. 4. Average duration of labor in primiparas patients grouped according to the degree of cervical dilatation at the time epidural analgesia was started. Column indicates duration of labor divided into time before (white) and after (grey) start of epidural analgesia

pain, which is frequently a sign of uterine dystocia. We have examined the records of 392 primiparas receiving epidural analgesia for pain relief (Fig. 4). In the group that had the epidural analgesia started before a cervical dilatation of 4 cm., a marked prolongation of the average duration of labor was noted. However, in these patients the average duration of labor prior to the start of analgesia was equal to that of the other groups. This indicated the inadvertent selection of a group of patients with slow and early painful labor by using pain as the main criterion for the administration of analgesic drugs.

In order to demonstrate the indications of methods of pharmaco-analgesia an attempt has been made to correlate the phases of labor, intensity of pain and the techniques applicable for pain relief at a particular phase of labor (Fig. 5).

A. Sedatives and analgesic drugs

Tranquillizers may be indicated early in labor to counteract emotional disturbances. Barbiturates are best suited to induce sleep and should be limited to that purpose. All narcotic analgesics are depressants to to the infant and should be used in a selected dosage;



METHODS OF ANALGESIA AND ANAESTHESIA RELATED TO PROGRESS OF LABOUR AND ESTIMATED ACCOMPANYING INTENSITY OF PAIN (Schematic)
(MODIFIED FROM WYLIE AND MAYRHOFER)

Fig. 5.

50 mg. demerol or the equivalent are adequate in most cases. Combination of a tranquillizing agent with a moderate dose of an opiate has found favor with many. In our hospitals a combination of demerol (25 mg.), promethazine (25 mg.), and hyoscine (0.2 mg.). (Willprodine) is widely used, providing sedation, analgesia, and some amnesia with a minimal effect on the fetus. Very occasionally larger doses of an opiate are indicated. Fetal depression is greatest 3-4 hours after an

injection of demerol and appropriate measures for resuscitation should be prepared if delivery falls within that time interval. In such cases narcotic antagonists may be indicated.

B. General anesthesia

It requires skill and experience to give a safe general anesthetic for obstetrical delivery. The patient is usually in severe distress, poorly prepared, and has a full stomach. Aspiration with subsequent pneumonitis (Mendelson's syndrome) is a dreaded complication. Fetal hypoxia and its sequelae have often been blamed on anesthesia, however with modern techniques the oxygen saturation of fetal blood is higher than with regional anesthesia or natural childbirth. Although there is a slightly higher incidence of fetal depression and resuscitation, uncomplicated general anesthesia in experienced hands causes no increased fetal mortality.

For safe anesthesia in obstetrics, the same principles should be applied that are used in the operating room. Since an empty stomach cannot be obtained and methods to empty it before anesthesia are uncertain and repulsive, the level of anesthesia should either be carried light enough to keep the laryngeal reflexes active (stage of analgesia) or deepened to stage of surgical anesthesia, possibly in conjunction with the use of a cuffed endotracheal tube. Systemic analgesia can be provided by the intermittent inhalation of Trilene or Penthrane in air or nitrous oxide in oxygen. The techniques of self inhalation have the advantage that loss of consciousness will terminate the inhalation; this is preferable to the administration of these agents by untrained personnel. Nitrous oxide in air is a hypoxic mixture and should not be used.

The anesthetist should be allowed sufficient time to induce the proper depth of anesthesia before instrumentation is attempted. Penthrane and Halothane can be used for this purpose. Anectine has been used in intermittent injections of 20-40 mg. following the inhalation of a mixture of 6 liters nitrous and 2 liters

oxygen for about one minute. Controlled ventilation is mandatory and the patient may have to be intubated. The same technique, after an induction with 100-150 mg. of Thiopentone, is our method of choice for cesarean section under general anesthesia. Penthrane is satisfactory but the induction is slow. Muscle relaxants of the tubocurarine type are best avoided. Thiopentone should only be used in moderate doses where a rapid induction is desirable. Fluothane relaxes uterine muscle but this may be complicated by increased bleeding. Ether and cyclopropane are becoming less popular as both are inflammable and cause nausea and vomiting. Favorable results have also been reported with Fluoroxene.

C. Regional anesthesia

Interruption of the sympathetic nerve supply to the uterus renders contractions pain free (Fig. 2). This can be accomplished by a paravertebral block or the easier technique of a paracervical block. For the latter method special needles and a plastic catheter for a continuous technique are commercially available. Results with this technique have been favorable, with a low incidence of complications. The sacral plexus is unaffected and for a forceps delivery infiltration of the vulva and a pudendal block are indicated. A trans-vaginal pudendal nerve block is frequently employed by obstetricians, often in conjunction with self inhaled Trilene; pain relief is adequate, but less complete than with the following techniques.

Continuous caudal or lumbar epidural infiltration is probably the most effective way to obtain pain relief for labor and delivery. At Victoria Hospital, London, lumbar epidural analgesia has been increasingly favored during the last five years (Fig. 6) and has significantly reduced the use of general anesthesia. A plastic catheter is introduced at the level of L2-3 and small doses of xylocaine or carbocaine (4-6 ml. of a 1-1.5% solution) are injected at intervals (hourly or as required) to block the 11th and 12th thoracic segment. Larger volumes are then used to anesthetize the birth

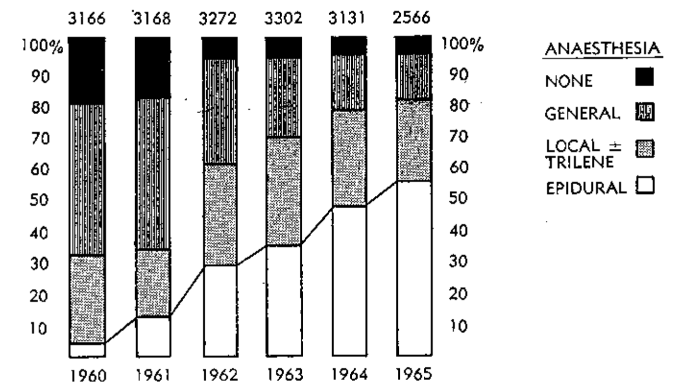


Fig. 6. Techniques for obstetrical anesthesia 1960-1965 at Victoria Hospital, London, Canada (in percent of total deliveries, which are indicated at the top of each column)

canal for the second stage of labor and delivery. Epidural analgesia is maintained for 4-8 hours in primiparas and 2-4 hours in multiparas on the average, but as long as 24 hours if required.

Single injection into the epidural space by the lumbar or caudal route has become popular. The limited duration of the local anesthetic effect makes it necessary to withhold the block until the cervical dilatation is nearly completed. The same applies for the saddle block spinal anesthesia. These techniques abolish the bearing down reflex, necessitating delivery with outlet forceps in the majority of patients. The most frequent complication with epidural analgesia is hypotension, which can be avoided by using small doses of local anesthetics.

III. Abdominal decompression

This technique has been reported mainly from South Africa. The abdomen is surrounded by a plastic cuirass and negative pressure is applied at the time of uterine contraction; the patient operates the vacuum pump and regulates the duration and the degree of negative pressure. The mechanism of action is not

quite understood but satisfactory pain relief is reported in a high percentage during the first stage of labor.

The anesthetist

A competent anesthetic staff should be able to administer general and regional anesthesia, making it possible to choose according to the needs of the patient and the obstetrician. (Trans-vaginal injections are best done by the obstetrician.) Under such circumstances none of the techniques mentioned have decisive advantages over each other in regard to adverse effects on the fetus. Drug depression will probably be of more serious consideration in premature infants. However, drugs and anesthetic agents represent only one of the several mechanisms that may induce respiratory depression or apnea in the fetus. Considering effectiveness of pain relief and adaptability to the obstetrical requirements continuous regional anesthetic techniques are superior.

Regardless of the type of analgesia and anesthesia used, resuscitation will be required in a small number of infants and here the maintenance of a clear airway and the timely institution of intermittent positive pressure ventilation are indispensable. External cardiac massage has been occasionally employed with success where a cessation of the fetal heart was observed during the delivery. The anesthetist is usually most skilled and experienced in resuscitation techniques. Regardless of the type of obstetrical anesthesia employed a competent anesthetist should be available on the obstetrical floor at all times.

Summary

Pain relief during childbirth is not only desirable but often necessary for success and safety in obstetrics. There is no single method which would provide universally satisfactory results. Consideration must be given to the patient's need, the obstetrical requirement, and the available pain relieving methods in each case to obtain optimal results.